

62
OCTOBER, 1925

25 Cents \$1 a Year

Contractors' *and* Engineers' Monthly

THE JOHN CRERAR
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OCT 22 1925



Sewer Laid in Rock Cut
in New York City
See page 56

Build Permanent Concrete Roads



THERE is a simple way of putting permanence into your concrete road construction. Use Truscon Highway Products. Tests have shown a 25% longer life and 80% decrease in maintenance where the road is reinforced with Truscon Wire Mesh and protected against effects of heat and frost with Truscon Contraction Joints.

Write for free 80-page "Modern Road Construction"

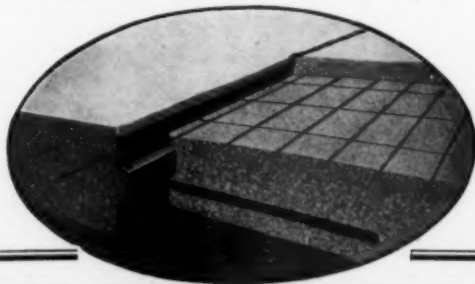
TRUSCON STEEL COMPANY YOUNGSTOWN OHIO

Warehouses and Sales Offices in Principal Cities
Foreign Div.: New York, Canada: Walkerville, Ont.

TRUSCON
HIGHWAY PRODUCTS



Truscon Curb Bars, Wire Mesh and Contraction Joints are Highway Products scientifically designed to protect concrete road construction against the stresses of heavy traffic and severe weather conditions.



Where to Purchase

A comprehensive classification of the leading machinery and supply manufacturers arranged for the convenience of contractors, engineers and public officials who may wish to secure information about construction equipment.



The Index to Advertisers faces the inside back cover. When writing to advertisers please mention the CONTRACTORS' & ENGINEERS' MONTHLY. A star (*) before the manufacturer's name indicates that his advertisement appears in this issue.

AIR COMPRESSORS

- *American Steam Pump Co., Battle Creek, Mich.
- *Curtis Pneumatic Mch. Co., St. Louis, Mo.
- *Domestic Engine & Pump Co., Shippensburg, Pa.
- *Novo Engine Co., Lansing, Mich.
- *O. K. Clutch & Mach. Co., Columbia, Pa.
- *Sullivan Mch. Co., Chicago, Ill.
- Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- Chicago Pneumatic Tool Co., New York
- De Laval Steam Turbine Co., Trenton, N. J.
- De La Vergne Machine Co., New York.
- Fairbanks, Morse & Co., Chicago, Ill.
- Gardner Governor Co., Quincy, Ill.
- General Electric Co., Schenectady, N. Y.
- Hardie-Tyner Mfg. Co., Birmingham, Ala.
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- Nordberg Mfg. Co., Milwaukee, Wis.
- Norwalk Iron Works Co., South Norwalk, Conn.
- Schramm, Inc., West Chester, Pa.
- United Iron Works, Inc., Kansas City, Mo.
- Westinghouse Trac. Brake Co., Wilmerding, Pa.
- Worthington Pump & Mch. Corp., New York.

ARC LAMPS

- General Electric Co., Schenectady, N. Y.
- Westinghouse Elec. & Mfg. Co., E. Pittsburg, Pa.

ARTESIAN WELL DRILLS AND PUMPS

- Am. Well Works, Aurora, Ill.

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- *Carey Co., Philip, Cincinnati, Ohio.
- Keebey & Mattison Co., Ambler, Pa.
- Millicoll Bros. Co., Wabash, Ind.
- Norristown Mag. & Ash. Co., Norristown, Pa.
- Sall Mountain Co., Chicago, Ill.

ASH HANDLING MACHINERY

- *Bay City Dredge Wks., Bay City, Mich.
- *Byers Mach. Co., Ravenna, Ohio
- *Hais Mfg. Co., Gen., New York
- *Mack Trucks, Inc., New York
- *Lakewood Eng. Co., Cleveland, Ohio.
- *Mead-Morrison Mfg. Co., E. Boston, Mass.
- Bartlett & Snow Co., O. O., Cleveland, O.
- Brown Hoisting Mach. Co., Cleveland, Ohio.
- Chain Belt Co., Milwaukee, Wis.
- Gifford-Wood Co., Hudson, N. Y.
- Green Eng. Co., East Chicago, Ind.
- Jeffrey Mfg. Co., Columbus, Ohio.
- Link-Belt Co., Chicago, Ill.
- Portable Machinery Co., Passaic, N. J.
- Robins Conv. Belt Co., New York.
- Webster Mfg. Co., Chicago, Ill.
- Weller Mfg. Co., Chicago, Ill.

ASPHALT

- *Barber Asphalt Co., Philadelphia, Pa.
- *Barrett Co., New York.
- *Kentucky Rock Asphalt Co., Louisville, Ky.
- *Standard Oil Co. (Indiana), Chicago, Ill.
- *Texas Co., New York.
- *Warren Bros. Co., Boston, Mass.
- Atlantic Refining & Asphalt Corp., Phila., Pa.
- Gulf Refining Co., Pittsburgh, Pa.
- Headley Good Roads Co., Philadelphia, Pa.
- New Orleans Refining Co., New Orleans, La.
- Pioneer Asphalt Co., Lawrenceville, Ill.
- Sinclair Ref. Co., Chicago, Ill.
- Standard Oil Co. of Calif., San Francisco, Cal.

- Standard Oil Co. of La., New Orleans, La.
- Standard Oil Co. of N. J., Newark, N. J.
- Standard Oil Co. of N. Y., New York.

ASPHALT BLOCK

- Hastings Pavement Co., New York.

ASPHALT CUTTERS

- *Sullivan Machinery Co., Chicago, Ill.
- Dayton Pneumatic Tool Co., Dayton, Ohio.
- Chicago Pneumatic Tool Co., New York.
- Independent Pneumatic Tool Co., Aurora, Ill.
- Ingersoll-Rand Co., New York.

ASPHALT KETTLES. (See Kettles for Asphalt and Tar Heating.)

ASPHALT PLANTS, TOOLS, ETC.

- *Aerell Burner Co., Union Hill, N. J.
- *Barber Asphalt Co., Philadelphia, Pa.
- *Littleford Bros., Cincinnati, O.
- *Warren Bros. Co., Boston, Mass.
- Bacon Co., Edw. R., San Francisco, Cal.
- Chase & Lyman, Boston, Mass.
- Cummer & Son Co., F. D., Cleveland, O.
- Farasey Co., J. D., Cleveland, Ohio
- Hetherington & Berner, Indianapolis, Ind.

ASPHALT ROLLERS. (See Road and Paving Rollers.)

ASPHALT SURFACE HEATERS

- *Aerell Burner Co., Union Hill, N. J.
- *Barber Asphalt Co., Philadelphia, Pa.
- *Chausse Oil Burner Co., Goshen, Ind.
- *Equitable Asphalt Maint. Co., Kansas City, Mo.
- *Hauck Mfg. Co., Brooklyn, N. Y.

BACKFILLERS

- *American Cement Mch. Co., Inc., Keokuk, Ia.
- *Baker Mfg. Co., Springfield, Ill.
- *Bay City Dredge Wks., Bay City, Mich.
- *Byers Machine Co., Ravenna, Ohio.
- *Construction Mch. Co., Waterloo, Iowa
- *Harnischfeger Corp., Milwaukee, Wis.
- *Koehring Co., Milwaukee, Wis.
- Austin Machinery Corp'n, Muskegon, Mich.
- Ersted Mach'y Mfg. Co., Portland, Ore.
- Parsons Co., Newton, Ia.
- Speeder Mach'y Corp., Fairfield, Iowa
- Weller Mfg. Co., Chicago, Ill.

BAR BENDERS AND CUTTERS

- *Koehring Co., Milwaukee, Wis.
- Buffalo Forge Co., Buffalo, N. Y.
- Concrete Steel Co., New York.
- Electric Welding Co., Pittsburgh, Pa.
- Hinman & Co., D. A., Sandwich, Ill.
- McKenna Co., Cleveland, Ohio.
- Ransome Concrete Mch. Co., Dunellen, N. J.

BAR CHAIRS, REINFORCING

- Truscon Steel Co., Youngstown, Ohio.
- *Universal Form Clamp Co., Chicago, Ill.
- Concrete Steel Co., New York.

BARS, IRON AND STEEL

- Ames & Co., W., Jersey City, N. J.

* Indicates that the manufacturer carries an advertisement. See index facing inside back cover.*

KOEHRING DANDIE Light Mixer

**4 Cylinder
Gasoline
Engine**



FAST! Fast! Fast! Here is a light mixer with a speedy charging skip, liberal drum dimensions and a high speed discharge that will break all your records of putting concrete where it pays you profits!

Just the balanced light weight to haul behind your truck on its rubber tired disc wheels and get from job to job in a big hurry.

Four cylinder, radiator cooled, gasoline engine. Transmission from engine to drum enclosed in oil bath! Double gear drum drive, chilled, beveled gears! Drum rollers fixed to shafts revolving in big bearings! It's useless to try to give you the smallest idea of what this Dandie represents in superior speed and construction details—but it's *strong, rugged*—it will stand-up for all the punishment you can give it, and *work and work, and work!*

And you have a chance to buy at a price that gives you all the benefit of the economies the Koehring Company effect by big, standardized production! If you had half an idea of what this mixer means in the way of actual value, you would send back the coupon for full detail by next mail!

KOEHRING COMPANY MILWAUKEE WISCONSIN

PAVERS, MIXERS—GASOLINE CRANES, DRAGLINES AND SHOVELS

Sales Offices and Service Warehouses in principal cities

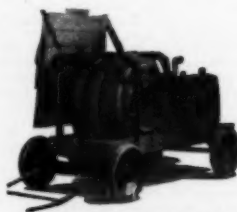
Foreign Dept., Room 1370, 50 Church St., New York City.

Canada, Koehring Company of Canada, Limited, 105 Front St., East, Toronto, Ontario.

Mexico, F. S. Lapum, Cinco De Mayo 21, Mexico, D. F.

Dandie Light Mixer

7 cu. ft. Mixed Concrete. Two or four cylinder gasoline engine. Power charging skip, or low charging hopper and platform. Rubber tired steel disc wheels or steel rimmed wheels.



A2829-III-IV

■■■■■■■■■■ **SEND BACK THIS COUPON!** ■■■■■■■■■■

KOEHRING COMPANY, Dept. D 6 - Milwaukee, Wis.

Please send me by return mail complete information on Koehring Dandie Light Mixer. Also price with equipment as follows:

Name..... Address.....

When writing to advertisers, please mention the Contractors' & Engineers' Monthly—Thank you.

Where to Purchase

5

Bethlehem Steel Co., Bethlehem, Pa.
 Buffalo Bolt Co., N. Tonawanda, N. Y.
 Carbon Steel Co., Pittsburgh, Pa.
 Carnegie Steel Co., Pittsburgh, Pa.
 Columbia Steel Corp., San Francisco, Cal.
 Franklin Steel Works, Franklin, Pa.
 Gulf States Steel Co., Birmingham, Ala.
 Hirsch Rolling Mill Co., St. Louis, Mo.
 Illinois Steel Co., Chicago, Ill.
 Inland Steel Co., Chicago, Ill.
 Laclede Steel Co., St. Louis, Mo.
 Midvale Steel & Ordnance Co., Philadelphia, Pa.
 Milton Mfg. Co., Milton, Pa.
 Pacific Coast Steel Co., San Francisco, Cal.
 Pollack Steel Co., Cincinnati, O.
 Horace T. Potts & Co., Philadelphia, Pa.
 Republic Iron & Steel Co., Youngstown, O.
 Jos. T. Ryerson & Son, Inc., Chicago, Ill.
 St. Louis Screw Co., St. Louis, Mo.
 Sweet's Steel Co., Williamsport, Pa.
 Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
 United Alloy Steel Corp., Canton, Okla.

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 *Lakewood Eng. Co., Cleveland, O.
 *Western Wheeled Scraper Co., Aurora, Ill.
 Easton Car & Constn. Co. of Mo., Kansas City, Mo.
 Western Wheeled Scraper Co., Aurora, Ill.

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 Cincinnati Rubber Mfg. Co., Cincinnati, Ohio.
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 Goodyear Tire & Rubber Co., Akron, O.
 Republic Rubber Co., Youngstown, Ohio.
 Robins Conv. Belt Co., New York
 Salisbury & Co., Inc., W. H., Chicago, Ill.
 Southern Rubber & Belt Co., Houston, Tex.
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 *Good Roads Mach'y Co., Kennett Square, Pa.
 *Russell Grader Mfg. Co., Minneapolis, Minn.
 *Universal Road Machinery Co., Kingston, N. Y.
 Austin Mfg. Co., Chicago, Ill.
 Birmingham Tank Co., Birmingham, Ala.
 Brown Hoisting Machy. Co., Cleveland, O.
 Erie Steel Const. Co., Erie, Pa.
 Fairfield Engineering Co., Marion, Ohio
 Gallion Iron Works & Mfg. Co., Gallion, Ohio
 Link-Belt Co., Chicago, Ill.
 Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
 Ransome Concrete Machy. Co., Dunellen, N. J.
 Weller Mfg. Co., Chicago, Ill.

BLAST HOLE DRILLING MACHINES. (See "Well Drilling and Blast Hole Machines")

BLASTING POWDER (See Explosives.)

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*Boston & Lockport Block Co., East Boston, Mass.
 *Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
 Upson-Walton Co., Cleveland, Ohio.

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Oxwell Acetylene Co., Newark, N. J.

BLUE PRINT MACHINES

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 Keuffel & Esser Co., Hoboken, N. J.
 Pease Co., O. F., Chicago, Ill.
 Weber & Co., F., Philadelphia, Pa.
 Wickes Bros., Saginaw, Mich.

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 Kolesch & Co., New York.

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 Chandler & Taylor Co., Indianapolis, Ind.
 Chatta. Boiler & Tank Co., Chattanooga, Tenn.
 Cole Mfg. Co., R. D., Newnan, Ga.

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 Hartley Boiler Works, Montgomery, Ala.
 Heine Boiler Co., St. Louis, Mo.
 E. Keeler Co., Williamsport, Pa.
 Ladd Co., Geo. T., Pittsburgh, Pa.
 Loeffel & Co., J., Springfield, O.
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 Murray Iron Works Co., Burlington, Ia.
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 Petroleum Iron Works Co., Sharon, Pa.
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 Stanwood Corp., Cincinnati, Ohio.
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 Valk & Murdoch Co., Charleston, S. C.
 Vogt Mch'y. Co., Inc., Louisville, Ky.
 Walsh & Weldner Boiler Co., Chattanooga, Tenn.

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Channon Mfg. Co., Jas. H., Chicago, Ill.
 Duff Mfg. Co., Pittsburgh, Pa.
 Kalamazoo Fdry. & Mach. Co., Kalamazoo, Mich.
 Waldo Bros. & Bond Co., Boston, Mass.

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 Abendroth & Root Mfg. Co., Newburgh, N. Y.
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 Babcock & Wilcox Co., New York
 Biggs Boiler Wks., Akron, Ohio.
 Casey-Hedges Co., Chattanooga, Tenn.

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 Glauber Brass Mfg. Co., Cleveland, O.
 Haydenville Co., Haydenville, Mass.
 Hays Mfg. Co., Erie, Pa.
 Mueller Company, Decatur, Ill.
 United Brass Mfg. Co., Cleveland, O.

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 Chicago Pneumatic Tool Co., New York.
 Cleveland Rock Drill Co., Cleveland, Ohio
 Ingersoll-Rand Co., New York.

BRICK, PAVING (See Paving Brick)

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 *Russell Grader Mfg. Co., Minneapolis, Minn.
 *Frederick Snare Corporation, New York.
 American Bridge Co., New York.
 Bellefontaine Bridge & Steel Co., Bellefontaine, O.
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 Berlin Constr. Co., Berlin, Conn.
 Bethlehem Steel Co., Bethlehem, Pa.
 Boston Bridge Works, Boston, Mass.
 Central States Bridge Co., Indianapolis, Ind.
 Champion Bridge Co., Wilmington, O.
 Chesapeake Iron Works, Baltimore, Md.
 Chicago Bridge & Iron Works, Chicago, Ill.
 Clinton Bridge Wks., Clinton, Iowa.
 Eastern Bridge & Struc. Co., Worcester, Mass.
 Flour City Orn. Iron Co., Minneapolis, Minn.
 Fort Pitt Bridge Works, Pittsburgh, Pa.
 Ingalls Iron Works Co., Birmingham, Ala.
 Inter. Steel & Iron Co., Evansville, Ind.
 Louisville Bridge & Iron Co., Louisville, Ky.
 McClintic Marshall Co., Pittsburgh, Pa.
 Milwaukee Bridge Co., Milwaukee, Wis.
 Minn. Steel & Mch'y. Co., Minneapolis, Minn.
 Missouri Vy. Bldg. & Iron Co., Leavenworth, Kan.
 Morava Constr. Co., Chicago, Ill.
 Mt. Vernon Bridge Co., Mt. Vernon, Ohio.
 Penn. Bridge Co., Beaver Falls, Pa.
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 Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
 Richmond Struc. Steel Co., Richmond, Va.
 Riverside Bridge Co., Martins Ferry, O.
 Wise Bridge & Iron Co., North Milwaukee, Wis.

BRONZE TABLETS

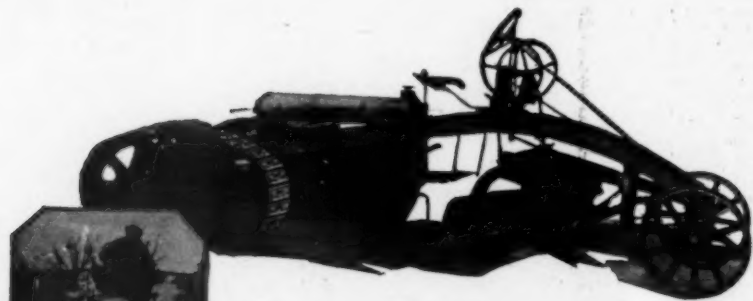
Flour City Orn. Iron Co., Minneapolis, Minn.
 Imperial Brass Mfg. Co., Chicago, Ill.
 Mott Iron Wks., J. L., New York.

BROOMS (See Street Sweeping Brooms)

BUCKETS, AUTOMATIC DUMPING

*Lakewood Engineering Co., Cleveland, O.
 *Littleford Bros., Cincinnati, O.
 Steubner Iron Works, G. L., L. I. City, N. Y.

* Indicates that the manufacturer carries an advertisement. See index facing inside back cover.*



Speeds Up Road Work Another Notch

Fordson power behind a Rooter-equipped H-P "One Man" Grader eats up road work at a phenomenal saving of time and cost.

Use the rooter before the grader blade and move more material per hour. One man does the ditching, rooting, grading, road and street maintenance and snow removal. Saves the work of a gang and four-fifths of the cost of horse-drawn graders.

H-P Rigid Rail Tracks convert the Fordson into a crawler and double its pulling power.

The wonderful power of the Fordson makes it possible for us to attach a Roller back of the "One-Man Grader." This grades the roads, fills the ruts and rolls the road in one operation. The roller can be attached or detached in 15 minutes.

Write for full particulars of our Grader, Scarifier, Roller and Rigid Rail Tracks. They mean money saved. Do it today!

The Hadfield-Penfield Steel Co.

Bucyrus, Ohio



HADFIELD
PENFIELD



When writing to advertisers, please mention the Contractors' & Engineers' Monthly—Thank you.

Where to Purchase

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BUCKETS, CLAM SHELL

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- *Hais Mfg. Co., Geo. New York.
- *Kiesler Co., J. P., Chicago, Ill.
- *Lakewood Engineering Co., Cleveland, O.
- *Mead-Morrison Mfg. Co., E. Boston, Mass.
- Brown Hoisting Mch. Co., Cleveland, O.
- Browning Co., Cleveland, O.
- Erie Steel Const'n Co., Erie, Pa.
- Coleman Co., F. A., Cleveland, O.
- Hayward Co., New York.
- Industrial Works, Bay City, Mich.
- Link-Belt Co., Chicago, Ill.
- McMyler Interstate Co., Cleveland, Ohio
- Orton & Steinbrenner Co., Chicago, Ill.
- Owen Bucket Co., Cleveland, Ohio.
- Williams Co., G. H., Erie, Pa.

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- *Koppel Ind. Car & Equip. Co., Koppel, Pa.
- *Lakewood Engineering Co., Cleveland, O.
- *Smith Co., T. L., Milwaukee, Wis.
- Inaley Mfg. Co., Indianapolis, Ind.
- Ransome Concrete Mch. Co., Dunellen, N. J.
- Union Iron Works, Inc., Hoboken, N. J.

BUCKETS, DRAGLINE

- *Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
- *Pioneer Bucket Co., Indianapolis, Ind.
- *Russell Grader Mfg. Co., Minneapolis, Minn.
- *Sauerman Bros., Chicago, Ill.
- Green, L. P., Chicago, Ill.
- Page Engineering Co., Chicago, Ill.

BUCKETS, DREDGING AND EXCAVATING

- *Blaw-Knox Co., Pittsburgh, Pa.
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- *Lakewood Engineering Co., Cleveland, O.
- *Mead-Morrison Mfg. Co., E. Boston, Mass.
- Brown Hoisting Mch. Co., Cleveland, O.
- Browning Co., Cleveland, O.
- Hayward Co., New York.
- Owen Bucket Co., Cleveland, Ohio.
- Williams Co., G. H., Erie, Pa.

BUCKETS, ORANGE PEEL

- *Kiesler Co., J. P., Chicago, Ill.
- *Mead-Morrison Mfg. Co., E. Boston, Mass.
- Hayward Co., New York.
- Industrial Works, Bay City, Mich.
- McMyler Interstate Co., Cleveland, O.
- Orton & Steinbrenner Co., Chicago, Ill.

BUILDERS' HARDWARE

- Corbin, P. & F., New Britain, Conn.
- Reading Hardware Co., Reading, Pa.
- Russell & Erwin Mfg. Co., New Britain, Conn.
- Sargent & Co., New Haven, Conn.
- Stanley Works, New Britain, Conn.
- Yale & Towne Mfg. Co., Stamford, Conn.

BUILDINGS, STEEL (See Bridges and Buildings)

BUNKS AND COTS

- Fort Pitt Bedding Co., Pittsburgh, Pa.
- Haggard & Marcussen Co., Chicago, Ill.
- Southern Rome Co., Baltimore, Md.

CABLES (See Wire and Cables)

CABLEWAYS

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- Waterbury Co., New York.

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- Foundation Co., New York.
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- Petroleum Iron Works Co., Sharon, Pa.

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- *Solvay Process Co., Syracuse, N. Y.
- Carbide Calcium Co., Carbondale, Pa.

CALCULATING MACHINES

- Burrenburgh Adding Machine Co., Detroit, Mich.
- Dalton Adding Mach. Co., Cincinnati, O.
- Felt & Tarrant Mfg. Co., Chicago, Ill.
- Marchant Calc. Machine Co., Oakland, Cal.
- Monroe Calculating Machine Co., Orange, N. J.

CANS FOR GARRAGE AND STREET REFUSE

- American Can Co., New York.
- Butler Mfg. Co., Minneapolis, Minn.
- Economy Baler Co., Ann Arbor, Mich.
- Rochester Can Co., Rochester, N. Y.
- Solar-Sturges Mfg. Co., Chicago, Ill.
- Steel Basket Co., Cedar Rapids, Iowa.

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- *Koppel Ind. Car & Equip. Co., Koppel, Pa.
- *Lakewood Engineering Co., Cleveland, O.
- Atlas Car & Mfg. Co., Cleveland, O.
- Austin Machinery Corp'n, Muskegon, Mich.
- Chase Fdry. & Mfg. Co., Columbus, O.
- Easton Car & Const'n Co., Easton, Pa.
- Hunt Co., C. W., W. New Brighton, N. Y.
- Stuebner Iron Works, G. L., L. I. City, N. Y.
- United Iron Works, Inc., Kansas City, Mo.
- Weller Mfg. Co., Chicago, Ill.
- Whiting Corp., Harvey, Ill.

CARTS, CONCRETE

- *Insley Mfg. Co., Indianapolis, Ind.
- *Lakewood Eng. Co., Cleveland, Ohio.
- *Littleford Bros., Cincinnati, O.
- *Smith Co., T. L., Milwaukee, Wis.
- *Sterling Wheelbarrow Co., Milwaukee, Wis.
- Akron Barrow Co., Cleveland, Ohio.
- Etnyre & Co., E. D. Oregon, Ill.
- Gray Iron Fdry. Co., Reading, Pa.
- Lee Trailer & Body Co., Chicago, Ill.
- Ransome Concrete Mch. Co., Dunellen, N. J.
- Toledo Wheelbarrow Co., Toledo, Ohio.

CAST IRON PIPE (See Pipe, Cast Iron)

CASTINGS, STREET AND SEWER

- *Burch Plow Wks. Co., Crestline, Ohio.
- *Central Foundry Co., New York.
- *U. S. Cast Iron Pipe & Fdry. Co., Burlington, N. J.
- Canton Foundry & Machine Co., Canton, O.
- Cassey-Hedges Co., Chattanooga, Tenn.
- Clow & Sons, J. B., Chicago, Ill.
- Dee Co., W. E., Chicago, Ill.
- Elkhart Fdry. & Mach. Co., Elkhart, Ind.
- Foundry Mfg. Co., St. Albans, Vt.
- Gilbert Mfg. Co., Aberdeen, S. Dak.
- Klauer Mfg. Co., Dubuque, Iowa.
- Madison Foundry Co., Cleveland, O.
- Pechstein Iron Works, Keokuk, Ia.
- Portable Machinery Co., Passaic, N. J.
- Sessions Foundry Co., Bristol, Conn.
- South Bend Foundry Co., South Bend, Ind.

CATCH BASINS (See Castings, Street and Sewer)

CATCH BASIN CLEANING APPARATUS

- *Mack Trucks, Inc., New York.
- Elgin Sales Corp., New York.

CAULKING MACHINERY AND TOOLS

- Helwig Mfg. Co., St. Paul, Minn.
- Ingersoll-Rand Co., New York.
- Mueller Company, Decatur, Ill.

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LAST year we made some startling claims for the new Center Drive Truck for Thew Shovels —“foolish claims,” some folks said.

These claims probably did sound too good to be true to shovel users, in the face of past experience.

Anyway, we heard the merry Hal Hal! as well as the honest doubts that always greet something radically new.

But all that is now a thing of the past.

Last year, shovel users had to take our word for Center Drive performance, and many of them did. Today a flock of Center Drives are talking for themselves all over the country. The past year has settled all doubts

and proven every claim we made. In fact, owners are boosting them in a way we never would have dared to do ourselves. You don't have to take our word now.

Laughs of derision have given place to smiles of satisfaction. Even those who wanted to see them fail, if they are honest, have to admit that they have made good.

The Center Drive principle is the most talked of shovel development of many years. We are frequently asked to put Center Drive Trucks under other makes of shovels.

If you are not fully informed regarding this vital shovel improvement you owe it to yourself to get the facts. Watch one at work, talk to a user or ask us for details.

THE THEW SHOVEL COMPANY, LORAIN, OHIO

Thew Lorain Shovels

Where to Purchase

9

CERILLINGS, METAL

Berger Mfg. Co., Canton, O.
Canton Art Metal Co., Canton, O.
Globe Iron Roofing & Cor. Co., Cincinnati, O.
Newport Rolling Mill Co., Newport, Ky.
Klauser Mfg. Co., Dubuque, Iowa.
Mesker & Co., Geo. L., Evansville, Ind.
Milwaukee Corrugating Co., Milwaukee, Wis.
Wheeling Corrugating Co., Wheeling, W. Va.

CEMENT

*Pennsylvania Cement Co., New York.
Ktna Portland Cement Co., Detroit, Mich.
Allentown Portland Cement Co., Allentown, Pa.
Alpha Portland Cement Co., Easton, Pa.
Ash Grove Lime and Portland Cement Co., Kansas City, Mo.
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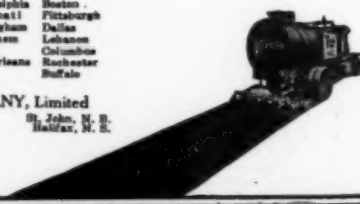
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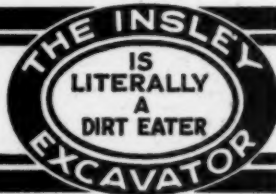
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- Austin Machinery Corp'n, Muskegon, Mich.
- Hayward Co., New York
- Nat'l Hoisting Engine Co., Harrison, N. J.
- Orton & Steinbrenner Co., Chicago, Ill.

DERRICK FITTINGS

- *S. Flory Mfg. Co., Bangor, Pa.
- *Lidgerwood Mfg. Co., New York

DIESEL ENGINES. (See Engines, Oil)

DISTRIBUTORS, TAR AND ASPHALT

- *Klaney Mfg. Co., Boston, Mass.

DISTRIBUTING PLANTS, CONCRETE

- *Archer Iron Works, Chicago, Ill.
- *Lakewood Engineering Co., Cleveland, O.
- *Inaley Mfg. Co., Indianapolis, Ind.
- Ransome Concrete Mch'y. Co., Dunellen, N. J.

DITCHING MACHINES. (See Excavators, Ditch and Trench)

DIVIDING PLATES (ROAD)

- *Godwin Co., W. S., Baltimore, Md.

DOORS AND SHUTTERS, STEEL ROLLING

- Cornell Iron Works, Inc., New York
- Klinebar Mfg. Co., Columbus, O.
- Variety Fire Door Co., Chicago, Ill.
- Wilson Corp., J. G., New York

DRAFTING MACHINES

- Universal Drafting Machine Co., Cleveland, O.

DRAINAGE TOOLS

- *Olliver Ames & Sons Corp., North Easton, Mass.
- *Ames Shovel & Tool Co., Boston, Mass.
- *Geo. Griffiths Co., Cheltenham, Pa.
- *The H. M. Myers Co., Beaver Falls, Pa.
- *T. Rowland's Sons, Inc., Cheltenham, Pa.
- *St. Louis Shovel Co., Plant, St. Louis, Mo.
- *Wright Shovel Co., Anderson, Ind.

DREDGES

- *Bay City Dredge Works, Bay City, Mich.
- *Lidgerwood Manufacturing Co., New York
- *Michigan Dredge Co., Bay City, Mich.
- *Osgood Co., The, Marion, O.
- American Steel Dredge Co., Fort Wayne, Ind.
- Bucyrus Co., South Milwaukee, Wis.
- Ellicott Machine Corp'n, Baltimore, Md.
- Erie Steam Shovel Co., Erie, Pa.
- Hayward Co., New York
- Marion Steam Shovel Co., Marion, O.
- Stockton Iron Works, Stockton, Cal.
- Street Bros. Machine Works, Chattanooga, Tenn.
- Superior Iron Works, Superior, Wis.

DREDGES, DIPPER

- *Bay City Dredge Works, Bay City, Mich.
- *Osgood Co., Marion, O.
- American Steel Dredge Co., Fort Wayne, Ind.
- Austin Machinery Corp'n, Muskegon, Mich.
- Bucyrus Co., South Milwaukee, Wis.
- Fairbanks Steam Shovel Co., Marion, O.
- Marion Steam Shovel Co., Marion, O.

DREDGES, HYDRAULIC

- Bucyrus Co., South Milwaukee, Wis.
- Ellicott Mach. Corp., Baltimore, Md.
- Fairbanks Steam Shovel Co., Marion, O.
- Marion Steam Shovel Co., Marion, O.
- Morris Machine Works, Baldwinville, N. Y.

DREDGING MACHINERY

- *S. Flory Mfg. Co., Bangor, Pa.
- *Lidgerwood Mfg. Co., New York

DREDGING PUMPS AND ACCESSORIES

- Erie Pump & Engine Wks., Medina, N. Y.

DRILLS, AIR AND ROCK

- *Dallett Co., The, Philadelphia, Pa.
- *Denver Rock Drill Mfg. Co., Denver, Colo.
- *McKiernan-Terry Drill Co., New York
- *Sullivan Machinery Co., Chicago, Ill.
- *Wood Drill Wks., Paterson, N. J.
- Chicago Pneumatic Tool Co., New York
- Cleveland Pneumatic Tool Co., Cleveland, Ohio
- Cleveland Rock Drill Co., Cleveland, Ohio
- Helwig Mfg. Co., St. Paul, Minn.
- Independent Pneumatic Tool Co., Chicago, Ill.
- Ingersoll-Rand Co., New York

DRILLS, CORE

- *McKiernan-Terry Drill Co., New York
- *Standard Diamond Drill Co., Chicago, Ill.
- *Sullivan Machinery Co., Chicago, Ill.
- Dobbins Core Drill Co., Inc., New York
- Ingersoll-Rand Co., New York

DRILLS, HAMMER (PNEUMATIC)

- *Denver Rock Drill Mfg. Co., Denver, Colo.
- *McKiernan-Terry Drill Co., New York
- *Sullivan Machinery Co., Chicago, Ill.
- *Wood Drill Works, Paterson, N. J.
- Chicago Pneumatic Tool Co., New York
- Cleveland Pneumatic Tool Co., Cleveland, O.
- Cleveland Rock Drill Co., Cleveland, O.
- Helwig Mfg. Co., St. Paul, Minn.
- Ingersoll-Rand Co., New York

DRILLS FOR WELLS AND BLAST HOLES (See Well Drilling Machinery)

DRUMS, HOLDING

- *Blaw-Knox Co., Pittsburgh, Pa.
- *Clyde Iron Wks. Sales Co., Duluth, Minn.
- *Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
- Hayward Co., New York
- Monaghan Machine Co., Chicago, Ill.

DRYERS, ASPHALT AND CEMENT

- Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- American Blower Co., Detroit, Mich.
- American Process Co., New York
- Atlas Dryer Co., Cleveland, O.
- Bartlett & Snow Co., C. O., Cleveland, O.
- Cumner & Son Co., F. D., Cleveland, O.
- Huggles-Coles Eng. Co., New York

DRYERS, SAND AND GRAVEL

- *Aaroll Burner Co., Union Hill, N. J.
- *Littleford Bros., Cincinnati, Ohio
- Bartlett & Snow Co., C. O., Cleveland, Ohio
- Chase & Lyman, Boston, Mass.

DUMP BODIES FOR MOTOR TRUCKS

- *Archer Iron Works, Chicago, Ill.
- *Easton Car & Const'n Co., Easton, Pa.
- *Hill Company, Milwaukee, Wis.
- *The Hug Co., Highland, Ill.
- *Hughes-Keenan Co., Mansfield, Ohio
- *Inaley Mfg. Co., Indianapolis, Ind.
- *Littleford Bros., Cincinnati, Ohio
- *Mack Trucks, Inc., New York
- *Marion Steel Body Co., Marion, Ohio
- *Superior Body Corp'n, Marion, Ind.
- *Stewart Iron Wks. Co., Cincinnati, Ohio
- *Wood Hydr. Hoist & Body Co., Detroit, Mich.
- American Truck & Body Co., Martinsville, Va.
- Columbia Body Corp., Columbia, Pa.
- Columbian Steel Tank Co., Kansas City, Mo.
- Ditwiler Mfg. Co., Gallon, Ohio
- Gallon All Steel Body Co., Gallon, Ohio
- Griscom-Russell Co., New York
- Herr Dump Car Mfg. Co., Costersville, Pa.
- Jennings Automatic Dump Body, Roanoke, Va.
- Lee Trailer & Body Co., Chicago, Ill.
- Mandit Body Co., Keokuk, Iowa
- Peckstein Iron Works, Keokuk, Iowa
- Van Dorn Iron Wks., Cleveland, Ohio

DUMP CARTS AND WAGONS, HORSE DRAW

- *Acme Road Machinery Co., Frankfort, N. Y.
- *Austin-Western Road Mach'y. Co., Chicago, Ill.
- *La Plant-Olcott Mfg. Co., Cedar Rapids, Ia.
- *Russell Grader Mfg. Co., Minneapolis, Minn.

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A recommendation from one user to a prospective user, such as this, is probably the best indication of the satisfactory performance of P & H Shovels. And it serves in a good measure to substantiate every claim we can make for them.

Maximum output, steady operation and real economy due to powerful crowding motion and low maintenance, are features largely responsible for more P & H Gasoline Shovels being in use than any other make.

Bulletin 82-X gives all the facts. Write for a copy.

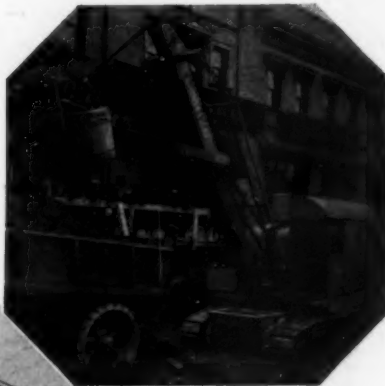
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P & H GASOLINE SHOVEL

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Columbia Body Corp., Columbia, Pa.
Convertible Wagon-Trailers, Inc., Buffalo, N. Y.
Eagle Wagon Works, Auburn, N. Y.
Gilbert Mfg. Co., Aberdeen, S. D.
Holsbog & Bro., Geo. H., Jeffersonville, Ind.
La Plant-Choate Mfg. Co., Cedar Rapids, Iowa
Little Red Wagon Co., Omaha, Neb.
Stockland Road Mach'y Co., Minneapolis, Minn.
Watson Products Corp., Canastota, N. Y.
Western Wheeled Scraper Co., Aurora, Ill.

DUST LAYING (CALCIUM CHLORIDE)

*Dow Chemical Co., Midland, Mich.
*Solway Process Co., New York
*Carbondale Calcium Co., Carbondale, Pa.

DYNAMITE (See Explosives)

EJECTORS, SEWAGE (See Sewage Ejectors)

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Louis Allis Co., Milwaukee, Wis.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Crocker-Wheeler Co., Ampere, N. J.
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Idea Elec. & Mfg. Co., Mansfield, O.
Lincoln Electric Co., Cleveland, O.
Robbins & Myers Co., Springfield, O.
Triumph Electric Co., Cincinnati, O.
Wagner Elec. Mfg. Co., St. Louis, Mo.
Western Electric Co., New York
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

ELECTRIC LAMPS

General Electric Co., Schenectady, N. Y.
Westinghouse Lamp Co., New York.

ELECTRIC LIGHTING PLANTS

*Climax Engineering Co., Clinton, Ia.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
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Fairbanks, Morse & Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Universal Motor Co., Oshkosh, Wis.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.
Western Electric Co., New York.

ELECTRIC SUPPLIES, METERS, ETC.

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Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

ELECTRIC TRANSFORMERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Kuhlman Electric Co., Bay City, Mich.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

ELECTRIC WIRES AND CABLES. (See "Wire and Cable")

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*Atlas Eng. Co., Milwaukee, Wis.
*Austin-Western Road Mach'y Co., Chicago, Ill.
*Good Roads Mach'y Co., Kennett Square, Pa.
*Hais Mfg. Co., Geo., New York.
*Littleford Bros., Cincinnati, Ohio.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*Spears-Wells Mach'y Co., Oakland, Cal.
*Universal Road Machinery Co., Kingston, N. Y.
Austin Mfg. Co., Chicago, Ill.
Bartlett & Snow Co., C. O., Cleveland, O.
Brown Hoisting Mach'y Co., Cleveland, O.
Chain Belt Co., Milwaukee, Wis.
Fairfield Engineering Co., Marion, Ohio
Gifford-Wood Co., Hudson, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Olson & Co., San'l, Chicago, Ill.
Robins Conv. Belt Co., New York.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.
Worthington Pump & Mch'y. Corp., New York.

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Amer. Elevator & Mach. Co., Louisville, Ky.
Atlantic Elevator Co., Inc., Philadelphia, Pa.
Bay State Elevator Co., Springfield, Mass.
Haughton Elev. & Mach. Co., Toledo, Ohio.
Kestner & Hecht Co., Chicago, Ill.
Llewellyn Iron Works, Los Angeles, Cal.
Montgomery Elevator Co., Moline, Ill.

Otis Elevator Co., New York.
Ridgway & Son Co., Coatesville, Pa.
See Elec. Elevator Co., A. B., New York.
Spidel, J. G., Reading, Pa.
Warner Elevator Mfg. Co., Cincinnati, O.
Warsaw Elevator Co., Warsaw, N. Y.

ENGINES, GAS AND GASOLINE

*Alamo Engine Co., Hillsdale, Mich.
*Caterpillar Tractor Co., San Leandro, Calif.
*Climax Engineering Co., Clinton, Ia.
*Domestic Engine & Pump Co., Shippensburg, Pa.
*Hercules Corp'n., Evansville, Ind.
*Hinkley Motors, Inc., Detroit, Mich.
*Novo Engine Co., Lansing, Mich.
*Turner & Moore Mfg. Co., Detroit, Mich.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Buda Co., Harvey, Ill.
C. H. & E. Manufacturing Co., Milwaukee, Wis.
Charter Gas Eng. Co., Sterling, Ill.
Chicago Pneumatic Tool Co., New York.
Cook Motor Co., Delaware, Ohio
Cushman Motor Wks., Lincoln, Neb.
Evinrude Motor Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Chicago, Ill.
Foss Gas Engine Co., Springfield, Ohio.
Fuller & Johnson Mfg. Co., Madison, Wis.
Gade Bros. Mfg. Co., Iowa Falls, Iowa.
Hercules Motors Corp., Canton, O.
John Lawson Mfg. Co., New Holstein, Wis.
Le Roi Co., Milwaukee, Wis.
Novo Engine Co., Lansing, Mich.
Sterling Engine Co., Buffalo, N. Y.
Universal Motor Co., Oshkosh, Wis.
Weber Engine Co., Kansas City, Mo.
Wellman-Seaver-Morgan Co., Cleveland, O.
Worthington Pump & Mch'y. Corp., New York.

ENGINES, HOISTING

(See Hoists)

ENGINES, KEROSENE

*Alamo Engine Co., Hillsdale, Mich.
*Climax Engineering Co., Clinton, Iowa

ENGINES, OIL

DIESEL

*Haddfield-Penfield Steel Co., Bucyrus, Ohio
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Busch-Sulzer Bros.-Diesel Eng. Co., St. Louis, Mo.
Fulton Iron Works Co., St. Louis, Mo.
McIntosh & Seymour Corp., Auburn, N. Y.
Nordberg Mfg. Co., Milwaukee, Wis.
St. Mary's Oil Eng. Co., St. Charles, Mo.
Western Mach'y. Co., Los Angeles, Cal.

SEMI-DIESEL

Anderson Fdry. & Mach. Co., Anderson, Ind.
Bessemer Gas Eng. Co., Grove City, Pa.
Buckeye Machinery Co., Lima, O.
Charter Gas Eng. Co., Sterling, Ill.
Chicago Pneumatic Tool Co., New York.
De La Vergne Machine Co., New York.
Fairbanks, Morse & Co., Chicago, Ill.
Foss Gas Engine Co., Springfield, Ohio.
Ingersoll-Rand Co., New York.
Lombard Governor Co., Ashland, Mass.
Muncie Oil Eng. Co., Muncie, Ind.
New London Ship and Engine Co., Groton, Conn.
Nordberg Mfg. Co., Milwaukee, Wis.
Stover Mfg. & Engine Co., Freeport, Ill.
Taylor Machine Co., Cleveland, O.
Weber Engine Co., Kansas City, Mo.
Worthington Pump & Mch'y. Corp., New York.

ENGINES, PUMPING

*Climax Engineering Co., Clinton, Ia.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Cushman Motor Wks., Lincoln, Neb.
Hooven, Owens, Rentschler Co., Hamilton, O.
Murray Iron Wks., Burlington, Ia.
Nordberg Mfg. Co., Milwaukee, Wis.
Worthington Pump & Mch'y. Corp., New York.

ENGINES, STEAM

*Dake Engine Co., Grand Haven, Mich.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Erie-Ball Engine Co., Pittsburgh, Pa.
Filer-Stowell Co., Milwaukee, Wis.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Lefell Co., J., Springfield, O.
Morris Machine Works, Baldwinville, N. Y.
Murray Iron Works Co., Burlington, Ia.
Nordberg Mfg. Co., Milwaukee, Wis.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Vilter Mfg. Co., Milwaukee, Wis.

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with Good Roads
snow equipment*



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- 5** Semi-circle with slots and lock pin permits setting of blade at any angle for right or left work, or for pushing straight ahead.
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EXCAVATING MACHINERY. (See Names Under Excavators, also Steam Shovels)

EXCAVATORS, CABLEWAY

- *American Mfg. & Eng. Co., Kalamazoo, Mich.
- *Lidgerwood Mfg. Co., New York.
- Bucyrus Co., South Milwaukee, Wis.
- Ersted Mach'y Mfg. Co., Portland, Ore.

EXCAVATORS, DITCH AND TRENCH

- *Barber-Green Co., Aurora, Ill.
- *Bay City Dredge Wks., Bay City, Mich.
- *Byers Machine Co., Ravenna, Ohio.
- *Clyde Iron Wks. Sales Co., Duluth, Minn.
- *Harnischfeger Corp., Milwaukee, Wis.
- *Isaley Mfg. Co., Indianapolis, Ind.
- *Keystone Driller Co., Beaver Falls, Pa.
- *Lidgerwood Mfg. Co., New York
- *Osgood Co., The, Marion, O.
- *Russell Grader Mfg. Co., Minneapolis, Minn.
- American Hoist & Derrick Co., St. Paul, Minn.
- Austin Machinery Corp'n, Muskegon, Mich.
- Brown Hoisting Mach'y Co., Cleveland, O.
- Buckeye Traction Ditcher Co., Findlay, Ohio.
- Bucyrus Co., South Milwaukee, Wis.
- Economy Excavator Co., Iowa Falls, Ia.
- Erie Steam Shovel Co., Erie, Pa.
- Ersted Mach'y Mfg. Co., Portland, Ore.
- Fairbanks Steam Shovel Co., Marion, O.
- Hayward Co., The, New York City.
- Marion Steam Shovel Co., Marion, O.
- Monighan Machine Co., Chicago, Ill.
- Owensboro Ditcher & Grader Co., Owensboro, Ky.
- Parsons Co., Newton, Ia.
- Speeder Mach'y Corp., Fairfield, Iowa
- Topping Mach'y Co., Chas. T. Dayton, O.

EXCAVATORS, DRAG-LINE

- *Bay City Dredge Works, Bay City, Mich.
- *Byers Machine Co., Ravenna, Ohio.
- *Clyde Iron Wks. Sales Co., Duluth, Minn.
- *Harnischfeger Corp., Milwaukee, Wis.
- *Lidgerwood Mfg. Co., New York
- *Osgood Co., The, Marion, O.
- *Russell Grader Mfg. Co., Minneapolis, Minn.
- *Sauerman Bros., Chicago, Ill.
- *Smith Co., T. L., Milwaukee, Wis.
- *Thew Shovel Co., Lorain, Ohio
- Austin Machinery Corp'n, Muskegon, Mich.
- Gallion Iron Works & Mfg. Co., Gallion, Ohio
- Brown Hoisting Mach'y Co., Cleveland, O.
- Browning Co., Cleveland, Ohio
- Bucyrus Co., South Milwaukee, Wis.
- Economy Excavator Co., Iowa Falls, Ia.
- Erie Steam Shovel Co., Erie, Pa.
- Ersted Mach'y Mfg. Co., Portland, Ore.
- Gade Excavator Works, C. L., Iowa Falls, Iowa.
- Green, L. P., Chicago, Ill.
- Hayward Co., New York.
- Industrial Works, Bay City, Mich.
- Link-Belt Co., Chicago, Ill.
- Marion Steam Shovel Co., Marion, O.
- Monighan Machine Co., Chicago, Ill.
- Speeder Mach'y Corp., Fairfield, Iowa

EXPANDED METAL

- *Truscon Steel Co., Youngstown, O.
- Berger Mfg. Co., Canton, O.
- Consolidated Expanded Metal Co., Braddock, Pa.
- Kalman Steel Co., Chicago, Ill.
- Northwestern Expanded Metal Co., Chicago, Ill.
- Youngstown Pressed Steel Co., Warren, O.

EXPANSION JOINT MATERIAL

- *Barber Asphalt Co., Philadelphia, Pa.
- *Barrett Co., New York
- *Carey Co., Philip, Cincinnati, Ohio.
- *Texas Company, New York.
- *Truscon Steel Co., Youngstown, O.
- Hoosier Asphalt Co., Alexandria, Ind.
- Pioneer Asphalt Co., Lawrenceville, Ill.
- Servicised Product Corp., Chicago, Ill.
- Waring-Underwood Co., Philadelphia, Pa.

EXPLOSIVES

- Atlas Powder Co., Wilmington, Del.
- De Pont de Nemours & Co., E. I., Wilmington, Del.
- Giant Powder Co., Cons., San Francisco, Cal.
- Grasselli Powder Co., Cleveland, O.
- Hercules Powder Co., Wilmington, Del.

FENCING

- *Stewart Iron Works Co., Cincinnati, Ohio
- *Wickwire Spencer Steel Corp., New York.

- Adrian Wire Fence Co., Adrian, Mich.
- American Steel & Wire Co., Chicago, Ill.
- Anchor Post Iron Works, New York.
- Cyclone Fence Co., Waukegan, Ill.
- Frost-Superior Fence Co., Warren, Ohio
- Indiana Steel & Wire Co., Muncie, Ind.
- Nitecliman Bros., Muncie, Ind.
- Michigan Wire Fence Co., Adrian, Mich.
- Page Steel & Wire Prod. Corp., Bridgeport, Conn.
- Pittsburgh Steel Co., Pittsburgh, Pa.
- Texas Cyclone Fence Co., Fort Worth, Tex.
- Youngstown Sheet & Tube Co., Youngstown, O.

FILING EQUIPMENT, STEEL

- Art Metal Constr. Co., Jamestown, N. Y.
- Berger Mfg. Co., Canton, O.
- General Fireproofing Co., Youngstown, O.
- Van Dorn Iron Works, Cleveland, O.

FILTERS, OIL

- Bowser & Co., Inc., S. F., Fort Wayne, Ind.
- Wayne Tank & Pump Co., Ft. Wayne, Ind.

FILTERS, WATER

- American Water Softener Co., Philadelphia, Pa.
- Graver Corporation, E. Chicago, Ind.
- International Filter Co., Chicago, Ill.
- Norwood Engineering Co., Florence, Mass.
- Roberts Filter Co., Darby, Pa.
- Scaife & Sons Co., W. B., Pittsburgh, Pa.

FINISHING MACHINES, CONCRETE ROAD (See Concrete Road Finishers)

FIRE ALARM SYSTEMS

- Gamewell Co., Newton Upper Falls, Mass.

FIRE ALARM SIRENS

- *Union Water Meter Co., Worcester, Mass.
- Erick Elec. Siren Co., St. Paul, Minn.
- Federal Sign System, Chicago, Ill.
- Hendrie & Bolthoff Mfg. & Sup. Co., Denver, Col.
- Sterling Siren Fire Alarm Co., Rochester, N. Y.

FIRE APPARATUS, MOTOR

- *Mack Trucks, Inc., New York.
- Ahrens-Fox Fire Engine Co., Cincinnati, O.
- American-La France Fire Eng. Co., Elmira, N. Y.
- Brockway Motor Fire App. Co., Cortlandt, N. Y.
- Foamite-Childs Corp., Utica, N. Y.
- Hale Fire Pump Co., Conshohocken, Pa.
- Northern Fire Apparatus Co., Minneapolis, Minn.
- Oberchain-Boyer Co., Logansport, Ind.
- Firsch & Sons Co., Peter, Kenosha, Wis.
- Prospect Fire Engine Co., Prospect, O.
- Seagrave Co., Columbus, O.
- Stuts Fire Engine Co., Indianapolis, Ind.
- Waterous Fire Engine Works, St. Paul, Minn.

FIRE EXTINGUISHERS, CHEMICAL

- American-La France Fire Eng. Co., Elmira, N. Y.
- Buffalo Fire Appliance Corp., Buffalo, N. Y.
- Cross Mfg. Co., C. J., Inc., New York.
- Foamite-Childs Co., Utica, N. Y.
- Pyrene Mfg. Co., Newark, N. J.

FIRE HOSE (See Hose, Fire)

FIREPROOF BUILDING MATERIAL

- *Truscon Steel Co., Youngstown, O.
- Berger Mfg. Co., Canton, O.
- Detroit Steel Prod. Co., Detroit, Mich.
- General Fireproofing Co., Youngstown, O.
- Kalman Steel Co., Chicago, Ill.
- Keasbey & Mattison Co., Ambler, Pa.
- Kinnear Mfg. Co., Columbus, O.
- National Fireproofing Co., Pittsburgh, Pa.
- United States Gypsum Co., Chicago, Ill.
- Youngstown Pressed Steel Co., Warren, O.

FIRST AID EQUIPMENT

- American-La France Fire Eng. Co., Elmira, N. Y.

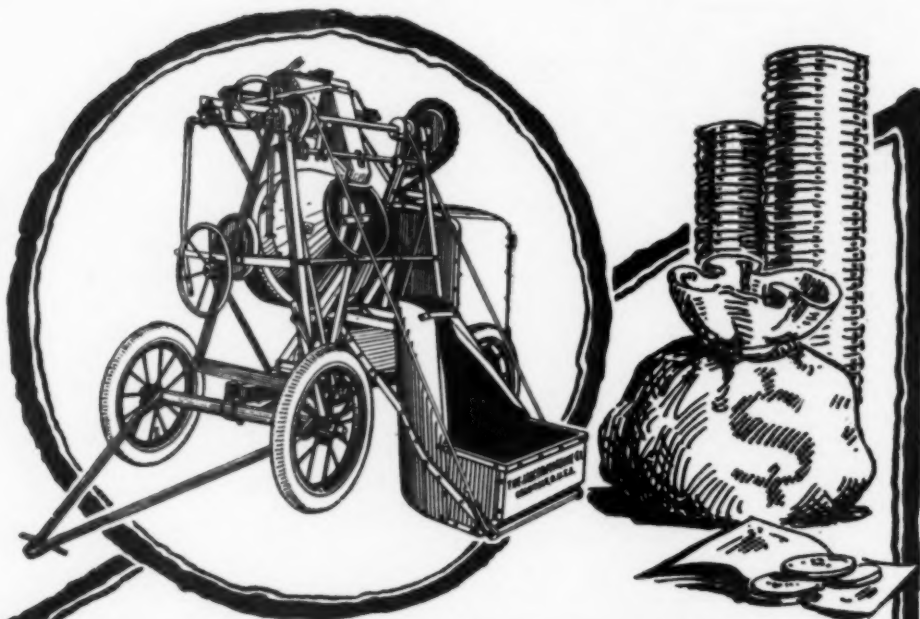
FLEXIBLE JOINTS

- *Central Foundry Co., New York
- *U. S. C. L. Pipe & Fdry Co., Burlington, N. J.
- Coldwell-Wilcox Co., Newburgh, N. Y.
- Crane Co., Chicago, Ill.
- United Lead Company, New York.

FLOORING, COMPOSITION

- *Barber Asphalt Co., Philadelphia, Pa.
- *Barrett Co., New York
- Am. Mason Safety Tread Co., Lowell, Mass.
- Johns-Manville, Inc., New York.
- Marine Decking & Supply Co., Phila., Pa.
- Muller, Franklin R. & Co., Waukegan, Ill.

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Jaeger Superiority Is Easily Demonstrated

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- *Midland Creosoting Co., Toledo, O.
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- *Soc. Wood Preserving Co., Atlanta, Ga.
- *Wyckoff Pipe & Creosoting Co., New York.

FLUSH TANKS

- *Pacific Flush Tank Co., Chicago and New York

FLUSHERS, STREET. (See Street Flushers and Sprinklers.)

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- *Schramm, Inc., Westchester, Pa.

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- *Schramm, Inc., Westchester, Pa.

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- *Archer Iron Works, Chicago, Ill.
- *Milwaukee Concrete Mixer Co., Milwaukee, Wis.

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- *Hell Co., Milwaukee, Wis.
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- *Stewart Iron Works Co., Cincinnati, Ohio
- *Superior Boiler Works, Marion, Ind.
- *Wood Hydr. Hoist & Body Co., Detroit, Mich.
- *American Production & Trading Co., Chicago, Ill.
- *Anthony Co., Streator, Ill.
- *Columbian Steel Tank Co., Kansas City, Mo.
- *Ditwiler Mfg. Co., Gallon, Ohio
- *Eagle Wagon Works, Auburn, N. Y.
- *Gallon All Steel Body Co., Gallon, O.
- *Griscom-Russell, New York.
- *Jennings Auto. Dump Body Co., Reanoke, Va.
- *Lee Trailer & Body Co., Chicago, Ill.
- *Mandt Co., Keokuk, Iowa.
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- *Twentieth Century Brass Wks., Belleville, Ill.

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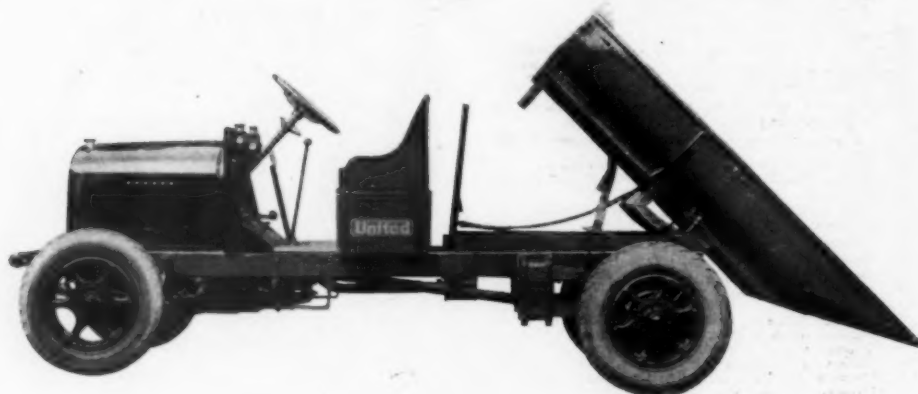
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GAS PRODUCERS
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Weller Mfg. Co., Chicago, Ill.

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*Lidgerwood Mfg. Co., New York
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*American Mfg. & Eng. Co., Kalamazoo, Mich.
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National Hoisting Engine Co., Harrison, N. J.
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Orr & Sombower, Reading, Pa.
Thomas Elevator Co., Chicago, Ill.
Treadwell Eng. Co., Easton, Pa.

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- *Littleford Bros., Cincinnati, O.
- Ransome Concrete Machy. Co., Dunellen, N. J.

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- Republic Rubber Co., Youngstown, O.
- U. S. Rubber Co., New York.

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- Iowa Valve Co., Oskaloosa, Ia.
- Kennedy Valve Mfg. Co., Elmira, N. Y.
- Norwood Engineering Co., Florence, Mass.
- Reusselner Valve Co., Troy, N. Y.
- Smith Mfg. Co., A. P., East Orange, N. J.
- Wood & Co., R. D., Philadelphia, Pa.

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- Vogt Mach. Co., Henry, Louisville, Ky.
- York Mfg. Co., York, Pa.

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- Gulick-Henderson Co., New York.
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- Buff & Buff Mfg. Co., Boston, Mass.
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- Gurley, W. & L. E., Troy, N. Y.
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- Leupold & Voelgel, Portland, Ore.
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- Pauly Jail Bldg. Co., St. Louis, Mo.
- Van Dorn Iron Works Co., Cleveland, O.

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(See Expansion Joint Material)

JOINTS, FLEXIBLE PIPE. (See Flexible Joints.)

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- *Universal Road Machinery Co., Kingston, N. Y.
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- Macleod Co., Cincinnati, Ohio.
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- Sykes Metal Lath & Roofing Co., Niles, O.
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- Ideal Power Lawn Mower Co., Lansing, Mich.
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- Penna. Lawn Mower Works, Philadelphia, Pa.
- Philadelphia Lawn Mower Co., Philadelphia, Pa.
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- Worthington Mower Co., Stroudsburg, Pa.

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- *Hauck Mfg. Co., Brooklyn, N. Y.
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LETTERING GUIDES

- Wood-Regan Instrument Co., Niagara Falls, N. Y.

LETTERS AND FIGURES, METAL

- Niagara Metal Stamp Corp., Niagara Falls, N. Y.

LIGHTS, CONTRACTORS'

- *Milburn Co., Alex., Baltimore, Md.
- Carble Mfg. Co., Duluth, Minn.
- General Electric Co., Schenectady, N. Y.
- Hauck Mfg. Co., Brooklyn, N. Y.
- Macleod Co., Cincinnati, O.
- Prest-O-Lite Co., Inc., New York.

LIGHTING STANDARDS. (See Street Lamp Posts)

* Indicates that the manufacturer carries an advertisement. See index facing inside back cover.*



The full-caterpillar mounting affords 100 per cent traction, and permits quick and positive moving up and turning.

How Bear Cat Owners Get Multiple Service

An Effective Skimmer-Ditcher Combination

THE owner of the Bear Cat pictured here secured a double contract, which included sewer and grading. With the ditcher attachment he dug the trench, "faster than we could lay the pipe," according to his own statement.

When the pipe was laid, he put a skimmer attachment on his Bear Cat and backfilled the trench with it. This job done, he next proceeded to the grading of the street with the skimmer, as shown in the photograph above. Thus with one machine he did all three

jobs, ditching, backfilling and grading, only one extra attachment being required.

This is just one of many such cases which will be illustrated from time to time in these pages. Contractors and public officials like the Bear Cat because it delivers the goods, and at a minimum expense. It is the one machine in its field capable of doing all sorts of tough work on all kinds of ground, and at the same time inexpensive to operate.

Wire, phone, or use the coupon.

THE BYERS MACHINE COMPANY, Ravenna, Ohio

Builders of Truck Cranes and 10 Ton Full Circle Cranes. Sales and Service, Throughout the Country



THE ALL-PURPOSE ONE MAN CRANE

Patents Pending



BYERS BEAR CAT

When writing to advertisers, please mention the Contractors' & Engineers' Monthly—Thank you.

Where to Purchase

25

HOPPERS, CONCRETE (Aggregate Measuring)

- *Insley Mfg. Co., Indianapolis, Ind.
- *Lakewood Engineering Co., Cleveland, O.
- *Littleford Bros., Cincinnati, O.
- Ransome Concrete Machy. Co., Dunellen, N. J.

HOSE, AIR

- *The Dallett Co., Philadelphia, Pa.
- Chicago Pneumatic Tool Co., New York.
- Cincinnati Rubber Mfg. Co., Cincinnati, O.
- Goodyear Tire & Rubber Co., Akron, O.
- Ingersoll-Rand Co., New York.
- Mulcahey Co., Inc., Phila., Pa.
- Penna Flexible Metallic Tubing Co., Phila., Pa.
- Republic Rubber Co., Youngstown, O.
- U. S. Rubber Co., New York.

HOSE, FIRE

- Bi-Lateral Fire Hose Co., Chicago, Ill.
- Eureka Fire Hose Mfg. Co., New York
- Fabric Fire Hose Co., New York.
- Goodrich Rubber Co., B. F., Akron, O.
- Goodyear Tire & Rubber Co., Akron, Ohio.

HOUSE NUMBERS

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HOUSES, PORTABLE. (See Buildings, Portable)

HYDRANTS, FIRE

- *Ludlow Valve Mfg. Co., Troy, N. Y.
- Chapman Valve Mfg. Co., Indian Orchard, Mass.
- Columbian Iron Works, Chattanooga, Tenn.
- Darling Valve & Mfg. Co., Williamsport, Pa.
- Eddy Valve & Mfg. Co., Watford, N. Y.
- Iowa Valve Co., Oskaloosa, Ia.
- Kennedy Valve Mfg. Co., Elmira, N. Y.
- Norwood Engineering Co., Florence, Mass.
- Reisselair Valve Co., Troy, N. Y.
- Smith Mfg. Co., A. P., East Orange, N. J.
- Wood & Co., R. D., Philadelphia, Pa.

HYDRAULIC RAMS

- Deming Co., Salem, O.
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- Rumsey Pump Co., Seneca Falls, N. Y.
- Seattle Machine Works, Seattle, Wash.

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- Baker Ice Machine Co., Omaha, Neb.
- Brunswick-Kroeschell Co., New Brunswick, N. J.
- Carbondale Machine Co., Carbondale, Pa.
- De La Vergne Machine Co., New York.
- Frick Co., Inc., Waynesboro, Pa.
- Triumph Ice Machine Co., Cincinnati, O.
- United Iron Works, Inc., Kansas City, Mo.
- Vilter Mfg. Co., Milwaukee, Wis.
- Vogt Mach. Co., Henry, Louisville, Ky.
- York Mfg. Co., York, Pa.

INCINERATORS, GARBAGE. (See Garbage Disposal)

INDICATOR POSTS. (See Valves)

INSPECTING LABORATORIES

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- Allentown Testing Laboratories, Allentown, Pa.
- Conwell & Co., E. L., Philadelphia, Pa.
- Gallick-Henderson Co., New York.
- Hunt & Co., Robert W., Chicago, Ill.
- N. Y. Testing Laboratories, New York.
- Pittsburgh Testing Laboratories, Pittsburgh, Pa.
- Standard Testing Laboratories, Inc., New York.

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- Buff & Buff Mfg. Co., Boston, Mass.
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- Gurley, W. & L. E., Troy, N. Y.
- Keuffel & Esser Co., Hoboken, N. J.
- Lieta Co., A., San Francisco, Cal.
- Leupold & Voelgel, Portland, Ore.
- Weber & Co., F., Philadelphia, Pa.
- White Co., David, Milwaukee, Wis.
- Wissler Instrument Co., St. Louis, Mo.

IRON WORK, STRUCTURAL AND ORNAMENTAL (See Bridges and Buildings)

JACKS, LIFTING

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- Duff Mfg. Co., Pittsburgh, Pa.
- Joyce-Cridland Co., Dayton, O.

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- Ree Mfg. Co., Pittsburgh, Pa.
- Templeton, Kenly & Co., Ltd., Chicago, Ill.
- Watson-Stillman Company, New York.

JACKS, PIPE FORCING

- Duff Mfg. Co., Pittsburgh, Pa.

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- *Stewart Iron Works Co., Cincinnati, O.
- Barnum Iron Works, E. T., Detroit, Mich.
- Pauly Jail Bldg. Co., St. Louis, Mo.
- Van Dora Iron Works Co., Cleveland, O.

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(See Expansion Joint Material)

JOINTS, FLEXIBLE PIPE. (See Flexible Joints.)

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- Honhorst Co., Jos., Cincinnati, Ohio.
- Macloed Co., Cincinnati, Ohio.
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- Tarrant Mfg. Co., Saratoga Springs, N. Y.
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- Handlan, Buck Mfg. Co., St. Louis, Mo.
- Star Headlight & Lantern Co., Rochester, N. Y.

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- Berger Mfg. Co., Canton, O.
- Bostwick Steel Lath Co., Niles, O.
- General Fireproofing Co., Youngstown, O.
- Milwaukee Corrugating Co., Milwaukee, Wis.
- Northwestern Expanded Metal Co., Chicago, Ill.
- Penn. Metal Co., Boston, Mass.
- Sykes Metal Lath & Roofing Co., Niles, O.
- Youngstown Pressed Steel Co., Warren, O.

LAWN MOWERS

- Chadborn & Coldwell Mfg. Co., Newburgh, N. Y.
- Coldwell Lawn Mower Co., Newburgh, N. Y.
- Gilson Mfg. Co., Port Washington, Wis.
- Ideal Power Lawn Mower Co., Lansing, Mich.
- Jacobsen Mfg. Co., Racine, Wis.
- Penna. Lawn Mower Works, Philadelphia, Pa.
- Philadelphia Lawn Mower Co., Philadelphia, Pa.
- Townsend Co., S. P., Bloomfield, N. J.
- Western Implement Co., Port Washington, Wis.
- Worthington Mower Co., Stroudsburg, Pa.

LEADITE

- Leadite Co., The, Philadelphia, Pa.

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- *Aeroll Burner Co., Union Hill, N. J.
- *Hauck Mfg. Co., Brooklyn, N. Y.
- *Littleford Bros., Cincinnati, O.
- Canton Fdry. & Machy. Co., Canton, O.
- Chicago Flexible Shaft Co., Chicago, Ill.
- Focht's Sons, Geo., Hoboken, N. J.
- Smith Mfg. Co., A. F., E. Orange, N. J.

LETTERING GUIDES

- Wood-Regan Instrument Co., Niagara Falls, N. Y.

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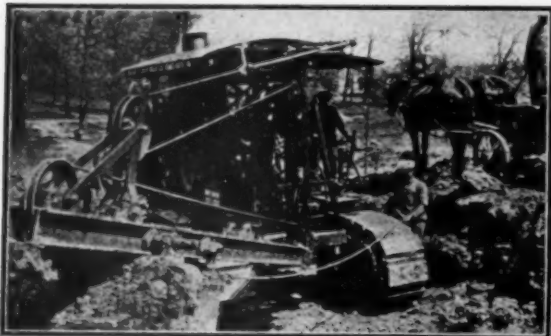
- Niagara Metal Stamp Corp., Niagara Falls, N. Y.

LIGHTS, CONTRACTORS

- *Milburn Co., Alex., Baltimore, Md.
- Carbie Mfg. Co., Duluth, Minn.
- General Electric Co., Schenectady, N. Y.
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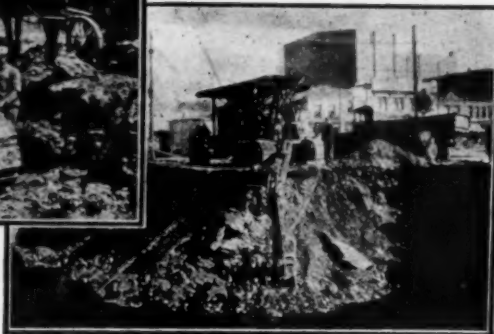
LIGHTING STANDARDS. (See Street Lamp Posts)

* Indicates that the manufacturer carries an advertisement. See index facing inside back cover.*



Above—Model 4 Keystone, Steam Drive, with $\frac{3}{4}$ -yard Skimmer. The bucket with a 14-foot crowd and a ten-ton thrust.

Below—Model 4 Keystone, Gas Drive, with Pull-stroke Ditcher Bucket. It stands on the solid and cuts any width or depth to 20 feet.



These are Original Keystone Features



42 Years of Fair Dealing

The Keystone Driller Company was born on Ground-hog Day, 1882, and still it sees its shadow grow.

Write for prices and descriptive literature

THE original and out-standing Keystone ideas in earth excavation are the *Skimmer Scoop* and *Pull-stroke Ditcher Bucket*. They are fully covered by patents issued and pending.

The *Skimmer* is a heavy and effective $\frac{3}{4}$ -yard bucket, with bottom hinged at the toothed end, and is carried upon an 18-foot boom giving it 14 feet of horizontal digging travel. Cuts a swath 32 feet wide leaving a smooth surface, finished to grade—the bucket ideal for road and street excavation.

The *Pull-stroke Ditcher* also has a hinged bottom which swings free in dumping and is self-cleaning in the stickiest clay. Made in eight sizes, 14" to 54" wide, and usable to a depth of 20 feet. In ditching it stands always on solid ground. In cellar excavation it operates from the street level and does not have to be hauled out of the pit at completion of the job.

The Keystone is a versatile, portable, general utility power shovel for contractors' use. It weighs 17 tons, has Crawler Mounting and is equipped with Climax Gas Engine (4 cylinder, 57 H.P., Model T U) or Keystone double 6x6 steam shovel engine (40 H.P. on brake test) as desired. The cost is low.

KEYSTONE DRILLER COMPANY — BEAVER FALLS, PENNA.

179 Broadway, New York

Monadnock Block, Chicago

Joplin, Mo.

KEYSTONE SHOVEL

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Where to Purchase

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- Arnold, Hoffman & Co., Inc., New York.
- Electro Bleaching Gas Co., New York.
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- Mathieson Alkali Works, Inc., New York.
- Penna. Salt Mfg. Co., Philadelphia, Pa.

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- *Atlas Engineering Co., Milwaukee, Wis.
- *Barber-Greene Co., Aurora, Ill.
- *Bay City Dredge Works, Bay City, Mich.
- *Halse Mfg. Co., Geo., New York.
- *Industrial Plants Corp., Toledo, O.
- *Russell Grader Mfg. Co., Minneapolis, Minn.
- *Sauerman Bros., Chicago, Ill.
- *Smith Co., T. L., Milwaukee, Wis.
- *Spears-Wells Mach'y Co., Oakland, Cal.
- *Universal Road Machinery Co., Kingston, N. Y.
- Austin Machinery Corp'n, Muskegon, Mich.
- Bonney Supply Co., Inc., Rochester, N. Y.
- Brown Hoisting Mach'y Co., Cleveland, O.
- Chain Belt Co., Milwaukee, Wis.
- Conant Machine Co., Concord Junction, Mass.
- Fairfield Engineering Co., Marion, Ohio
- Gifford-Wood Co., Hudson, N. Y.
- Green, L. P., Chicago, Ill.
- Jeffrey Mfg. Co., Columbus, O.
- Lee Traller & Body Co., Chicago, Ill.
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- Portable Mach'y Co., Passaic, N. J.
- Sackett Screen & Chute Co., H. B., Chicago, Ill.
- Specialty Eng. Co., Philadelphia, Pa.
- Weller Mfg. Co., Chicago, Ill.

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- East Jersey Pipe Co., New York.

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- Durand Steel Locker Co., Chicago, Ill.
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- Medart Mfg. Co., Fred., St. Louis, Mo.

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- American Locomotive Co., New York.
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- Davenport Locomotive Works, Davenport, Ia.
- Fate-Root-Heath Co., Plymouth, O.
- Lima Locomotive Wks., Lima, O.
- Industrial Equipment Co., Inc., Minster, O.
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- Plymouth Locomotive Works, Plymouth, O.
- Porter Co., H. K., Pittsburgh, Pa.
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METAL ROOFING (See "Roofing")

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- Clow & Sons, J. B., Chicago, Ill.
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- Mueller Company, Decatur, Ill.

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- *Pittsburgh Meter Co., Pittsburgh, Pa.
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- Sangamo Electric Co., Springfield, Ill.
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- *Pittsburgh Meter Co., Pittsburgh, Pa.
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MIXERS, GROUT

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- *Lakewood Engineering Co., Cleveland, O.
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- Harley-Davidson Motor Co., Milwaukee, Wis.
- Indian Motorcycle Co., Springfield, Mass.

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- *Hincley Motors, Inc., Detroit, Mich.
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- Buda Co., Harvey, Ill.
- Cushman Motor Wks., Lincoln, Neb.
- Le Roi Co., Milwaukee, Wis.
- Waukesha Motor Co., Waukesha, Wis.
- Wisconsin Motor Mfg. Co., Milwaukee, Wis.

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- *International Motor Co., New York.
- *United Motor Products Co., Grand Rapids, Mich.
- Acme Motor Truck Co., Cadillac, Mich.
- Atterbury Motor Car Co., Buffalo, N. Y.
- Autocar Co., Ardmore, Pa.
- Bessemer Motor Truck Co., Grove City, Pa.
- Brockway Motor Truck Co., Cortland, N. Y.

* Indicates that the manufacturer carries an advertisement. See index facing inside back cover.*



Here's the most expensive workman in the world

THIS fellow is big and husky. He has a 48-inch chest and a hand like a clam shell bucket. But he doesn't like to work.

He has a habit of sneaking on to contractor's payrolls. When he does the contractor says goodbye to profits.

The worst part

of it is, he's hard to see. But watch for him when the mixer is waiting for materials. Hunt him up on the rainy days when the paving crew can't work.

You'll recognize him easily as the most expensive workman in the world. No doubt you'll remember his name—"Old Man Overhead."

When profits dwindle

and disappear—when the bank balance follows suit—you'll see how little he has helped you. You'll see what a loafer he is.

And you'll see what keeps him fat and big. You'll see the expensive equipment that can't pay for its keep. You'll see the equipment that can't be used on short run work at a profit.

A Barber-Greene loading machine unloads sub-grade material for Arthur Hess, Redwood City, Calif. Barber-Greene makes money for their owners by handling such jobs as this in addition to loading and batching sand and gravel. Our booklet—"Contracting with Barber-Greene," shows the different jobs that Barber-Greene has been known to handle successfully.

You'll see the equipment that costs a lot to move, ship, erect and take down.

Maybe these things

will make you so disgusted that you'll answer an advertisement like this one.

And you'll put a couple of Barber-Greene's to work loading and batching from convenient stock piles. And you'll see materials pouring into the mixer and you'll see a long stretch of fresh concrete every time the five o'clock whistle blows.

And you'll save

money and time when you move to your next job. And you'll find your Barber-Greene ready to go to work the minute they get there. And in the off seasons you'll use them for sub-grading, excavating and similar work.

"Old Man Overhead" will have to tighten up his belt strap and get to work. The red ink will disappear from your books. And maybe you'll buy a new sedan and take a trip to California or Florida that winter.

Barber-Greene layouts that are helping contractors to wipe "Old Man Overhead" off their payrolls are shown in our latest road book, "Contracting with Barber-Greene." It's free to contractors and your copy is waiting for you.



BARBER-GREENE CO. 423 W. Park Av., Aurora, Ill.
Representatives in Five Cities
BARBER GREENE
Portable Belt Conveyors Self Feeding Bucket Loaders
Coal Loaders Automatic Ditch Diggers Coal Feeders

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Gramm Bernstein Truck Corp'n, Lima, O.
Gramm & Kincaid Motors, Inc., Lima, Ohio
The Hug Co., Highland, Ill.
Indiana Truck Corp'n., Marion, Ind.
International Harvester Co., Chicago, Ill.
Kelly Springfield Motor Truck Co., Springfield, O.
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Larrabee-Deyo Motor Tr. Co., Binghamton, N. Y.
Pierce-Arrow Motor Car Co., Buffalo, N. Y.
Republic Motor Truck Co., Alma, Mich.
Ruggles Motor Truck Co., Saginaw, Mich.
Service Motor Truck Co., Wabash, Ind.
Standard Motor Truck Co., Detroit, Mich.
Sterling Motor Truck Co., Milwaukee, Wis.
Stewart Motor Corp'n, Buffalo, N. Y.
Traffic Motor Truck Co., St. Louis, Mo.
U. S. Motor Truck Co., Cincinnati, O.
White Co., Cleveland, Ohio.

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OXFGEN

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Bausman Mfg. Co., Millersville, Pa.
Dow Co., Louisville, Ky.
Meyers Mfg. Co., Fred J., Hamilton, Ohio.
Mott Iron Wks., J. L., New York.

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Paving Rollers)

PAVING BLOCKS, CREOSOTED WOOD. (See "Creosoted Blocks")

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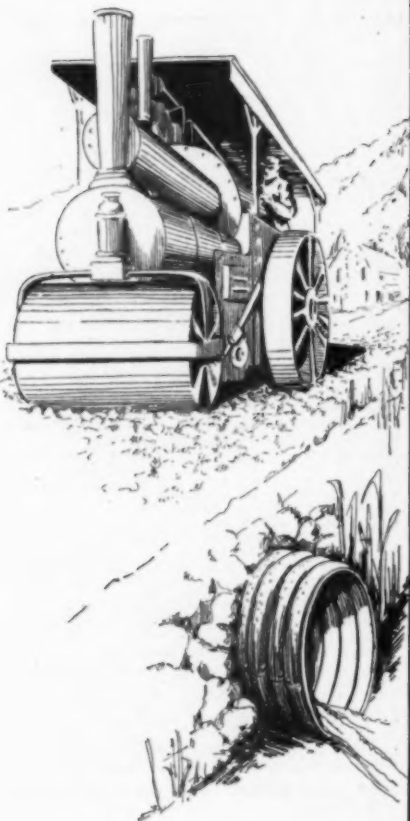
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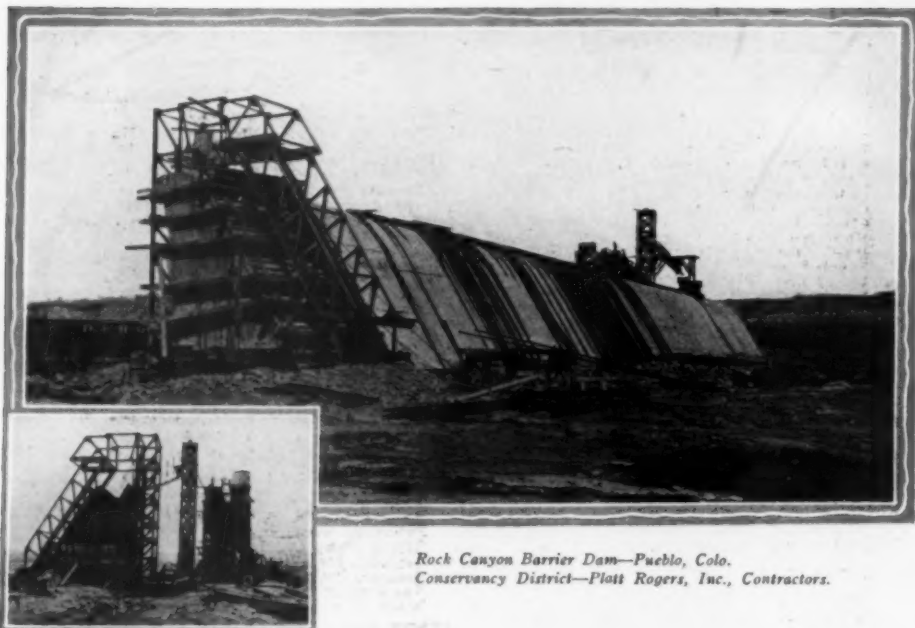
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ROCK DRILLS. (See Drills, Rock.)

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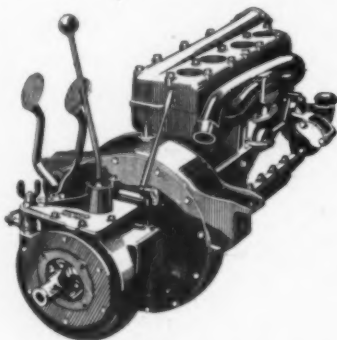
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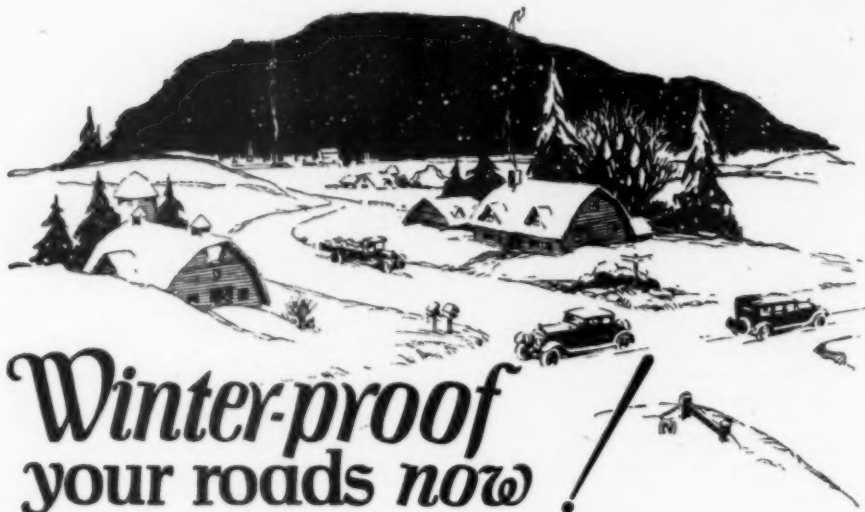
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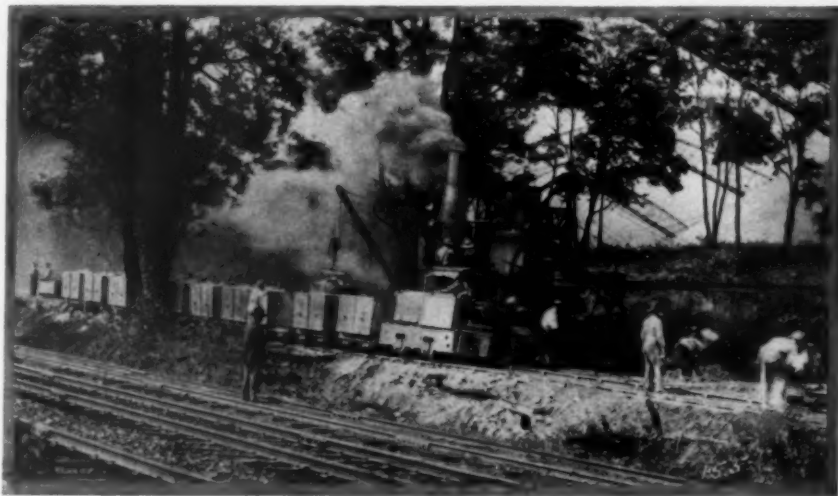
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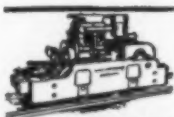
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Central Mixing Plants for the Manufacture of Pre-mixed Concrete

By W. E. Hart

Manager, Structural Bureau, Portland Cement Association

THE establishment of central plants for the production of ready-mixed concrete was suggested by the successful operation of similar plants for concrete highway paving. Mixed concrete from such plants is frequently hauled 4 or 5 miles with satisfactory results. With this in mind, it is natural that progressive material dealers should recognize the possibilities for the sale of ready-mixed concrete as well as the sale of the raw materials.

The operation of central plants on large construction jobs brought out a number of advantages which factory production has over hand work and which large permanent plants have over small temporary field plants. Materials can be handled by machinery from the time they leave the cars until they are delivered to the trucks as mixed concrete. This decreases the amount of hand labor required and economizes in the number of times the materials must be handled.

All measurements of materials and operations

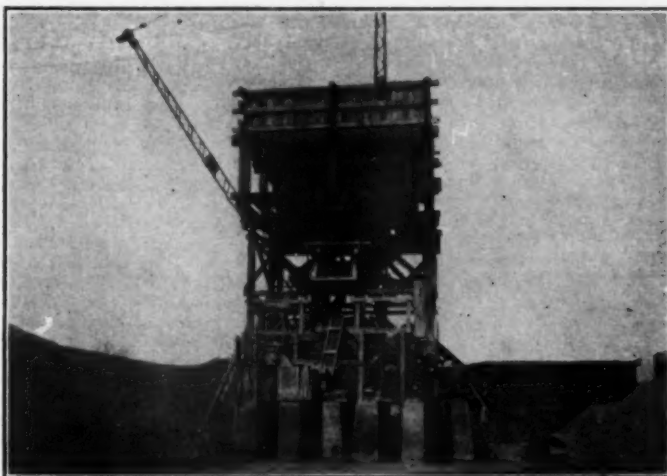
of the mixer can be handled by one or two men in a properly designed and equipped plant, while several men would be required in the field. The operator soon becomes more skilled and capable of producing a better and more uniform quality of concrete than the average field operator. A properly equipped central plant also is generally capable of measuring materials more accurately and obtaining more uniform proportions than field plants.

Other obvious advantages of a central plant are that it would eliminate the expense of moving field mixing equipment from one job to another; release the crew required to feed the mixer for use on other work; make the space usually occupied by the mixer and concrete materials available for other uses; and prevent the waste of cement, aggregates and sacks common to field work.

Some Disadvantages

Experience indicates that in the face of these

A CENTRAL
MIXING PLANT AT
DANVILLE, ILL.,
EQUIPPED WITH TWO
ONE-CUBIC-YARD
MIXERS



apparent advantages central mixing plants have a number of limitations and disadvantages which are not common to field plants. The use of ready-mixed concrete is limited to work where stiff mixtures can be employed. Concrete of a consistency like that generally used in reinforced work has a tendency to segregate when hauled a few blocks in a motor truck. The water and fine materials float to the top, and the sand and coarse materials compact into a solid mass at the bottom. When the truck is dumped, the water and fine materials flow out first, while the coarse materials hang in the truck until dug out with picks and shovels. Concrete in this condition is not suitable for use.

The regular schedule of deliveries to a job must be maintained in order to prevent tying up the work and causing loss of time by the contractor's force. This requires an ample number of trucks, and the difficulties are increased by traffic delays when the route extends through congested districts with heavy street traffic.

A considerable amount of capital is required to build and properly equip a plant and keep it operating until business can be built up enough to make the operation profitable. The idea is new to most contractors and users of concrete, and their prejudices and objections must be overcome before the volume of business can become large enough to show a profit. Contractors have money invested in mixing equipment and would not be justified in discarding their equipment until the success and field of ready-mixed concrete are established.

Established Plants

The sizes of the crews used at the seven plants that were studied varied from eight to twelve men with the plants operating at capacity. In the plant operated by eight men the distribution was as follows: one superintendent; one operator for locomotive crane; one mixer operator; one laborer feeding aggregate to bucket conveyor; one laborer measuring aggregates at mixer; one laborer cleaning out material cars; and two laborers handling cement.

The distribution of the twelve-man crew is as follows: one superintendent; one mixer operator; one laborer measuring aggregates, two laborers unloading cement from cars; two laborers feeding cement to mixer; one laborer switching cars with tractor; one derrick operator; one signal man; and two laborers cleaning cars. The full crew would be required only when the plant was operating at capacity. If operating intermittently, a well-designed plant could be handled by three or four men, assuming that one of them was capable of handling a crane, hoist, or mixer, as occasion demanded. At such times the other members of the full crew could be employed in other work about the material yard.

Location of Plant

The plant should be so located, designed, and equipped that it can be operated at full capacity with a minimum number of men. As these plants are ordinarily operated to best advantage by building-material dealers, the plant should be erected in an established material yard. There should be ample trackage available for cars of sand, stone, and cement, so that there may be little danger of a shut-down caused by lack of materials. Pro-

vision should be made for spotting loaded cars as desired without having to depend on a switching crew or hand-operated pinch bars. Some plants use gasoline tractors in this work. Others use a power winch, operating a cable direct to the cars or reeved through a system of blocks, while others are fortunate enough to have a locomotive crane or one mounted on crawler treads. Either system is satisfactory, and choice will depend on the local conditions and equipment available.

Equipment should be provided to unload materials rapidly with a minimum of manual labor. A derrick or crane equipped with a clam-shell bucket is probably the most commonly used. Under certain conditions, a belt, bucket, or screw conveyor system can be used to advantage. The success of such a system would usually depend on the delivery of aggregates in bottom- or side-dump cars which could be dumped into pits or underground bins from which the conveyor could deliver the material to the storage bins. Such a system, however, does not permit of a storage pile and demands a constant supply of cars in order to prevent shut-downs.

Plants operating in the northern states should be equipped to furnish warm concrete for cold-weather construction. But little additional equipment is required to heat the aggregates and water. An old boiler, unsuitable for high-pressure work, but still satisfactory to furnish steam at low pressure for aggregate bins, can be obtained at a little expense. A grillage of steam pipes perforated with $\frac{1}{4}$ -inch holes laid about 3 feet above the discharge gates of the bins containing fine and coarse aggregates, makes a very good arrangement for heating the aggregates. Water can be heated by any one of several schemes commonly used on construction work.

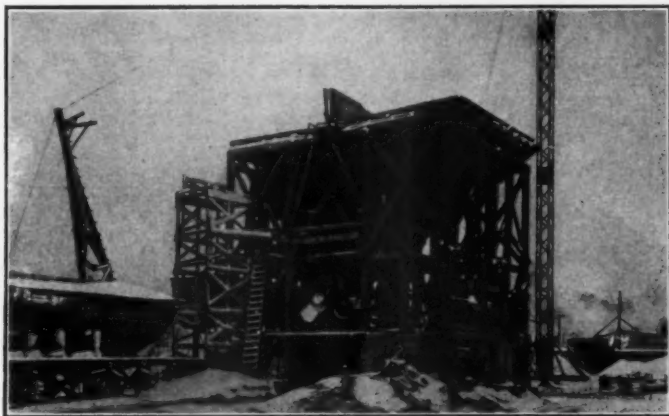
The mixer should be of such a size that it can deliver 30 cubic yards or more per hour. This ordinarily requires that the mixer have a capacity of not less than 1 cubic yard of mixed concrete per batch. One plant in Dallas has a mixer of 2 cubic yards capacity. Other plants are equipped with two mixers, each having a capacity of 1 cubic yard.

The measuring hoppers should be of such design that they will insure accurate measurements of all materials used under all conditions. It should be possible to adjust them quickly for batches of varying proportions, as a dozen jobs may be supplied in one day, each requiring a different mix.

Last summer a prominent Chicago contractor for the construction of a dam operated a central mixing plant which would have been ideal for a plant selling ready-mixed concrete. One of the most interesting features of this plant was that all materials were measured by weight. A steel hopper having a capacity of 50 cubic feet of loose materials was mounted under the aggregate bins on the frame of a dial scale. The 30-inch dial of the scale was about 6 feet back of the hopper in plain view of the operator; the aggregate bins dumped directly into the hopper through metal gates, and the cement was fed into it by a screw conveyor leading from the bottom of the cement storage bin about 30 feet away. One operator measured all materials and fed the one-yard mixer. Two mixers of the same size could have been supplied with ease by this operator.

**CENTRAL MIXING
PLANT OF THE
SHIDLER
CONSTRUCTION AND
MATERIALS COM-
PANY, KANKAKEE,
ILL.**

Note small shed at left, used for storage of sacked cement. Tower at left corner is to hoist cement to charging floor. Dry batches can be dumped into trucks from the measuring hopper through a chute behind the mixer.



In the charging of the hopper, the gate from the stone bin was opened, allowing stone to fall into the hopper until the pointer on the scale reached the mark for stone posted on the dial. As the pointer approached the mark, the flow was gradually cut off, and it stopped just as the pointer reached the mark. When the sand had been weighed out on top of the stone, the motor driving the screw conveyor was started by a controller mounted near the side of the hopper. When the required cement had been weighed, the motor was stopped and the contents of the hopper discharged into the mixer through a gate in the bottom.

The measurement of materials by weight has several advantages over the measurement by volume. One advantage is flexibility. No adjustment of the hopper or other equipment is necessary to change the proportions. Three different proportions were used on this job and markers in three colors were posted on the dial to show the weights of materials required for each. That is, a 1:2:4 mix was indicated by red markers, another mix was indicated by green, and another by black. The operator changed proportions by merely using a different set of markers. Complicated proportions, such as 1:1.3:3.4, could be measured as easily as more common proportions. A complete list of proportions with weights for each printed on a convenient card would enable the operator to deliver any mix desired without delay.

Another advantage of weighing equipment is its great accuracy. When water is added to dry sand, it swells, sometimes as much as 30 per cent. That is, if a cubic foot of dry sand weighing 100 pounds were mixed with 6 pounds of water, the volume of the sand and water may be increased to 1.3 cubic feet. A cubic foot of this moist sand would weigh only 81.5 pounds. If the measuring hopper were set to measure 12 cubic feet of sand, it would actually measure only 980 pounds of moist sand, instead of 1,200 pounds as intended. In other words, each batch of concrete would actually lack more than 2 cubic feet of sand on account of the bulking or swelling of the sand due to moisture. Concrete deficient in sand is richer in cement than intended and costs more per cubic yard than it should.

The variation in sand content in concrete and the error caused by bulking can be largely elimi-

nated if the sand is measured by weight instead of by volume. In order to insure greater uniformity in the quality and proportions of concrete batches, the Iowa State Highway Commission now requires that all aggregates, both fine and coarse, used on state highways shall be measured by weight. A correction for the estimated moisture content added on the scales practically eliminates errors in proportions due to bulking and moisture content of the sand.

Bulk cement is more difficult to measure accurately by volume than damp sand. The weight of a cubic foot of cement will vary as much as 25 per cent with the manner and degree of compacting. It can easily be measured by weight, as 94 pounds of cement is universally considered as 1 cubic foot.

Bulk cement has a number of advantages over sacked cement at permanent central mixing plants. It eliminates the work and expense of emptying, cleaning, baling, and shipping bags. It can be unloaded from cars into bins and handled from bins to mixer by machinery to better advantage than cement in bags. One of the most successful methods for unloading it is by means of a power scoop operated by two men with a small electric or gasoline hoist. One man inside the car drags the scoop back from the door, pushes it into the cement, and guides it, while the other man outside pulls the loaded scoop to the door with a small hoisting motor and a line running through a block at or near the door. When the loaded scoop reaches the door, it is dumped into the bin or into a small pit, whence the cement is carried to a bin by a conveyor. One large user of bulk cement finds that three men can unload three cars of bulk cement per day with this outfit.

When the cement storage bin is at one side of the material bins, it will usually be necessary to deliver the cement from the bins to the measuring hoppers by means of a belt or screw conveyor. This conveyor should be driven through a clutch or electric motor so that it can be started quickly and stopped when the amount of cement required for a batch has been delivered to the hopper.

Most storage bins for aggregate in plants now operating provide storage capacity of materials sufficient for three or four hours' capacity of the mixer plant. These bins are most conveniently located over the measuring hoppers so that mate-

rials can be drawn directly from the bins into the hoppers by gravity. When two or three grades of coarse aggregate are used, it may be advisable to provide an overhead bin for each.

An accurate control of the water content for each batch is essential to uniform consistency and necessary to successful hauling of mixed concrete. A water-measuring tank capable of quick adjustment for the varying amounts of water required should be provided at the mixer.

Mixed concrete has been delivered successfully in large trucks on solid tires. Where volumes are large, the roads well paved, and the hauls short, the large trucks will deliver concrete at a lower cost per ton-mile than the light trucks. When conditions are reversed, the light trucks will probably have an advantage. Pneumatic tires under heavy loads cost more per mile of operation than solid tires, but they cause less vibration and wear of the truck mechanism and less compacting of the concrete than solid tires.

Trucks on pneumatic tires can make better speed and therefore longer hauls than solid-tire trucks. Some central mixing plants do not own all their trucks, but contract for the delivery of the concrete with local trucking concerns, when extra trucks are required. This relieves the plant operator of investment in a large fleet of trucks and of the responsibility for their care and operation.

Experiments and tests carried on by the Bureau of Public Roads in 1921 show that the strength of concrete is not impaired when hauled for periods as great as three hours. These tests show that there is no danger of injury to concrete by hauling it for any economical distance, providing it is not segregated when deposited in its final position. These tests and field experience indicate that concrete compacts into a solid mass in trucks when it is hauled for a considerable time, and the rapidity and degree of compacting is greater with concrete of thin consistency than with concrete of stiff consistency. Concrete to be hauled more than a few blocks should be of such consistency that it would show a slump of not more than 4 inches when tested with the slump cone. Experience shows that concrete which has been thoroughly mixed will not segregate as quickly as that which has been imperfectly mixed. A minimum of 1½ minutes' mixing time is recommended.

When a load of concrete is compacted in a truck body it can be dumped only with difficulty unless special means are provided to clear the body when the load is dumped. Several schemes have been used to overcome this difficulty. In one method a piece of log chain is laid across the front end of the body, with the ends laid out along the bottom toward the rear. If the load does not clear itself from the body when dumped, a pull on the chain will usually clear the truck. Another plan is to provide a false bottom of canvas or sheet metal on the truck which slides two or three feet when the load is dumped. There is seldom need of such equipment, however, if the concrete is mixed for at least 1½ minutes and has a slump test within specified limits.

The application of the central mixing plant to commercial business must be confined to certain definite limits. Present-day knowledge sets as

a limit for such work a concrete with a slump not greater than 4 inches. The field for such plants is therefore limited to pavements, curbs, and gutter foundations, plain concrete floors, retaining walls and structural concrete with a sufficiently large section to permit the placing of concrete around the reinforcement with a reasonable amount of spading. Concrete should always be dumped from the truck to a batch-box. Under no circumstances should delivery be made directly into the forms. Concrete of the required consistency when placed directly in the forms cannot be spaded or spread properly without honeycombs and the exposing of reinforcing bars. Another feature that must be guarded against is the re-mixing of the concrete on the job by using additional water. Such a procedure will unquestionably reduce the strength of the concrete and lead to a practice on the job that will place the central mixing plant in disrepute.

Conclusion

In conclusion, permit me to sketch the advantages and disadvantages of the central mixing plant. One of the principal advantages of these plants is the fact that it places the mixing of the concrete in the hands of one man where the materials can be graded, proportioned, and mixed with greater uniformity than in the field. Manual labor is reduced and machinery substituted therefore. The expense of moving contractors' equipment from place to place is eliminated, and at the same time storage space for materials is eliminated on the job. Perhaps the greatest advantage in the central mixing plant is the fact that only the stiffer mixes can be transported. If the idea of the central mixing plant becomes established, we are sure of reducing very materially the water content in all concrete.

The principal limitation of the central mixing plant is one of transportation. Only the stiffer consistencies can be successfully delivered by trucks without segregation and settlement in the body of the truck. Other difficulties to be overcome are the transportation of concrete in congested areas and the necessity of avoiding delays in the transportation of these materials to a large construction job. At the same time, a great deal of prejudice is set up by the contractors due to the fact that they already have a great deal of expensive equipment on hand which cannot be discarded because of the character of their business. No doubt there will be a certain amount of prejudice in the minds of officials as to the exact results obtained by central mixing plants. They may be entirely in sympathy with laboratory tests and for that reason will rule out the use of central-mixed concrete, fearing that the ultimate strength of such concrete will be impaired by transportation. This, however, is a minor point, because mixed concrete has been transported by different means for a number of years.

Generally speaking, a central mixing plant is entirely practical and safe, providing it is in the hands of competent men. The same axiom applies to the central mixing plant as to any other class of work. It is not "the use, but the abuse" of a system that causes the difficulty.

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New York Building Congress Makes Craftsmanship Awards

Stonesetter and Bricklayer on New Telephone Building Awarded Certificates

ON Thursday, September 10, the last brick was laid and the last stone was set on the Barclay-Vesey Building of the New York Telephone Company, thus completing the work of these two trades on this vast and attractive structure.

Surrounded by a group of their fellow workers, representatives of the contractors, the architects, and the owners, Matthew D. Mahoney, a bricklayer, and George S. T. Bain, a stonemason, with neatness and dispatch completed their work on the structure.

A few moments later, on the fifth floor, certificates of craftsmanship were awarded to these two workers. The special committee of award consisted of Howard F. Thurber, Chairman, Executive Board, and H. C. Carpenter, General Manager, New York Telephone Company, owners of the building, Paul Gmelin, representing McKenzie, Voorhees & Gmelin, the architects of the building, Otto Eidlitz, representing Marc Eidlitz & Company, the contractors, John Halkett, President of the Building Trades Council, and J. J. Collins, of the Tunnel & Excavators Union, representing



STEPHEN F. VOORHEES, PRESIDENT NEW YORK BUILDING CONGRESS, PRESENTING CERTIFICATE TO CRAFTSMEN ON NEW YORK TELEPHONE BUILDING JOB



TYPE OF CERTIFICATE PRESENTED

labor, and Stephen F. Voorhees, President of the New York Building Congress, representing the Congress.

In the short addresses preceding the actual presentation of the certificates, it was emphasized that the workers to whom the certificates were being awarded were chosen not because they were the speediest workers at their trades, but because of their interest, ability, and craftsmanship. Awards are to be made later to the outstanding members in other trades working on this building as their work is completed. This is part of the plan of the New York Building Congress to lay emphasis on the value and essential importance of craftsmanship to stimulate interest and recognize conscientious pride in workmanship.

On Friday, September 18, similar awards were made to a bricklayer, a plumber, a plasterer, and a laborer who had been working on the new building of the National Bible Institute. This new 11-story structure is a residential school and headquarters of the Institute. It is laid out for classrooms, dormitories, cafeterias, and other accommodations for the students. The continuance of these awards will bring into being a guild of craftsmen whose ideals will greatly raise the standards of their trades.

Miscellaneous Notes

Front Cover Shows Portable Air-Compressor on Sewer Job

THE front cover illustration, for which we are indebted to the Domestic Engine and Pump Company, Shippensburg, Pa., shows one of the two No. 149 Domestic portable gasoline-engine-driven air-compressors which have a capacity of 184 cubic feet of free air per minute which were used on this job. The engine is of the four-cylinder, horizontal type, and the compressor has two cylinders of the vertical type. The outfit illustrated was purchased by the J. V. Timoney Construction Company and is shown in use on a sewer job at Isham Street and Park Terrace in the Washington Heights Section of New York City. It has been used continuously for the operation of two rotating drills.

Mundy Extending Factory Building

THE middle of July the J. S. Mundy Hoisting Engine Company, Newark, N. J., broke ground at 722 Frelinghuysen Avenue for a new factory building to be a two-story structure 40 x 140 feet. The building will be of reinforced concrete, brick, and steel, of similar architecture to the present building. The second floor will be occupied by the engineering, advertising and cost departments and pattern shop. The ground floor will be used for a machine shop which will be equipped with the most approved types of rapid-production machine tools. The building will be ready for occupancy about October 1 of this year.

New American Cable Distributors

THE American Cable Company, 105 Hudson Street, New York City, has announced the appointment of several new distributors, including the Marion Machine, Foundry & Supply Company, Marion, Ind.; J. Shuman Bower, 106 Foster Building, Utica, N. Y.; the Contractors' Equipment Company, 8 Steuben Street, Albany, N. Y., and John C. Louis, 221 S. Eutaw Street, Baltimore, Md.

New Full-Crawler Distributor

THE Full-Crawler Company, 500 Clinton Street, Milwaukee, Wis., has announced the appointment of the Monarch Equipment Company, St. Louis, Mo., as its distributor in the St. Louis branch territory of the Ford Motor Company. The Monarch Equipment Company will carry a complete stock of Trackson Full-Crawler treads for Fordson tractors, as well as repair parts.

Fine Progress for All-Western Road Show

THE August 20 meeting of the Western Construction Equipment Distributors who are fostering the All-Western Road Show to be held in San Francisco, November 9-14, reported applications for approximately 94,000 square feet of exhibit space. The meeting at which space reservations and preferences chosen by various exhibitors were drawn was presided over by P. H. Curtis of *Western Highways Builder* and drawings were in charge of C. C. Chamberlin of the Austin-Western Road Machinery Company, while R. T. McClelland of Ransome and McClelland presided at the charts. Four tents with a total area of 110,000 square feet

were set aside for road building and allied trades, and one tent of approximately 24,000 square feet was reserved for the Transportation Department.

The Motor Truck Division of the Motor Car Dealers Association of San Francisco decided to exhibit their lines as a unit and have indicated to the show management that they want at least one tent for their exhibit. This department will contain dump trucks, hoists, trailers, and other models particularly pertaining to transportation as applied to the road-building industry.

From all indications the entire 18 acres of show ground will be occupied by various types of exhibits. In addition to the demonstration show held outside, many concerns are planning to install working models of their machinery, operated by electricity or gas engines inside the tents. Many exhibits unique in this request have been reported to the show management. A full line of heavy excavating shovels down to a complete exhibit of engineering supplies will be offered. The most modern methods of cement finishing and asphalt mixing will be displayed. Tractors, graders, industrial locomotives and air-compressors and crushing machinery will add to the lines displayed for the interest of western road-builders.

Arrangements have been made to hold a banquet on the evening of the last day of the show, which will be in charge of L. E. Murphy, F. C. Edmonds and Stuart S. Smith. The committee promises a minimum of speeches and a maximum of food and entertainment, so that this affair will provide a brilliant wind-up to the week's events.

The following list of exhibitors were allotted space August 20. This list does not include the motor trucks which are to occupy a separate department of 25,000 square feet:

Chain Belt Co., Norris K. Davis, Construction Machinery Co., Novo Engine Co., Universal Crane Co., McMyler-Interstate Co., Byers Machinery Co., Northwest Engineering Co., Ransome Concrete Machinery Co., Harnischfeger Corp., Koehring Co., Jaeger Machinery Co., T. L. Smith Co., California Corrugated Culvert Co., Spears-Wells Machinery Co., Burch Flow Works, Insley Mfg. Co., Helzel Steel Form & Iron Co., A. W. French & Co., J. D. Adams & Co., Foote Co., Good Roads Machinery Co., A. L. Young Machine Co., Cresson-Morris Co., Watson Truck Corp., Ingersoll-Rand Co., G. H. Williams Co., C. D. Edwards & Co., Chicago Pneumatic Tool Co., Killefer Mfg. Co., Galion Iron Works & Mfg. Co., Austin-Western Road Machinery Co., Portland Cement Assn., Conneaut Shovel Co., George H. Haisa Co., Kwik-Mix Co., Smith Engineering Co., Rix Compressed Air & Drill Co., Climax Engineering Co., Lakewood Engineering Co., Brown Hoisting Machinery Co., Blaw-Knox Co., Buffalo-Springfield Roller Co., Stockland Road Machinery Co., Russell Grader Mfg. Co., Koppel Sales Co., Thew Shovel Co., Barber-Greene Co., Sauerman Bros., Owen Bucket Co., Speeder Machinery Corp., Fate-Root-Henth Co., Erie Steam Shovel Co., Clyde Iron Works, Lufkin Rule Co., Caterpillar Tractor Co., Gerlinger Steel Casting Co., Austin Machinery Co., S. Flory Mfg. Co., Butler Bin Co., Erie Steel Const. Co.

New Stockland Distributors in Illinois

THE Stockland Road Machinery Company, Minneapolis, Minn., has announced the appointment of the Illinois Equipment Company, with headquarters at Bloomington, Ill., to handle Stockland road machinery in central Illinois. The Illinois Equipment Company maintains branch sales offices at Springfield, Decatur, and Danville under the supervision of S. W. Bodman, Sales Manager, with headquarters at Bloomington.

Legal Points for Contractors

These brief abstracts of court decisions in the contracting fields may aid you in avoiding legal difficulties. Local ordinances or state laws may alter the conditions in your community. If in doubt, consult your own lawyer

Edited by A. L. H. Street Attorney-at-Law

Contractor's Right to Allowance for Extras Caused by Unforeseen Work

In constructing a sewer, extra work was entailed through the contractor's severing a water-main not shown on the plans and specifications. His right to extra compensation on this account was involved in the case of *Derr vs. Oklahoma City* (235 Pacific Reporter, 218) decided by the Oklahoma Supreme Court. Upholding the right, the Court said:

"A situation was created by the severance of the water-main which threatened another water-main which afforded fire protection. . . . It was necessary to take steps to stop the flow of water and protect the water-main which provided fire protection for the north part of the city. The accident meant extra work and expense to the plaintiff. The situation arose by reason of the failure of the city to show the location of this particular water-main. It was necessary for the city to make provisions to meet the error giving rise to the dangerous situation. The city under its contract was authorized to give the direction in writing, and specify the manner of doing the work, or it might give the instructions orally."

Contractor's Rights When Unexpected Difficulties Are Encountered

The following declarations made by the Oklahoma Supreme Court in the case of *Derr vs. Oklahoma City* (236 Pacific Reporter, 218), concerning a municipal sewer construction contract, seem to apply with equal force to all sorts of private construction contracts, as well as municipal work:

"The contractor will not be relieved from the performance of a municipal contract because he meets a situation incidental to the performance of the contract that was not anticipated by him, although such unexpected situations may add extra expense in completing the work [where he has not contracted against it]. . . .

"The formation of the earth to be excavated may be different from that anticipated by the builder, and the contractor may find quicksand where he anticipated finding rock formation for the foundation of the structure to be built, but this does not change the rule. He must meet the performance of the contract at the cost he contracted for.

"A different rule applies where the contractor must build and complete a structure according to the plans and specifications by the owner. The contractor will not be required to bear extra expense resulting from the performance of the contract on account of defects in the plans and specifications prepared and submitted by the owner."

Coverage of Subcontractor's Bond

Where there was no provision in the principal contract for construction of an irrigation ditch, nor in a subcontract, nor in the subcontractor's bond, therefor, one furnishing supplies to the subcontractor's employees was not entitled to sue on the bond, held the Texas Court of Civil Appeals in the recent case of *Smith vs. Fidelity & Deposit Company of Maryland*, 270 Southwestern Reporter, 1071. The Court observed:

"Cecil's [the subcontractor's] contract with the construction company was to construct three miles of irrigation ditches in accordance with the requirements of the contract of the construction company with the water improvement district . . . , and to execute a bond conditioned upon the full and faithful performance of his contract, and further conditioned that Cecil would 'pay all sums of money due and to become due for supplies, teams, equipment, material, or labor used or contracted to be used in the performance of said contract, as well as any and all other expenses incurred in the performance or attempted performance thereof.' Although the written contract between Cecil and the construction company bound Cecil to execute a bond payable to the construction company and the water improvement district, those were the only two conditions which were stipulated should be included in the bond. Neither the contractor [contract] nor the bond expressly stipulated that any one furnishing supplies to Cecil should have a right of action thereon, or that the same was made for his benefit. On the contrary, the only beneficiaries expressly named were the construction company and the water improvement district."

Limited Authority of Municipal Engineers to Contract

A provision in a municipal contractor's agreement that the town engineer should determine controversies arising between the parties was lately held by the New Jersey Supreme Court to give the engineer no authority to bind the town to pay for work. (*Giardini vs. Mayor and Board of Aldermen of Town of Dover*, 128 Atlantic Reporter, 798.) The Court remarked:

"Nothing in the contract or specification under which the work was performed, and which presents the sole basis of the engineer's power to represent the municipality, authorizes him to enter into an independent and distinct contract . . . from the specific contract which he was employed to supervise and direct. The provisions of the contract to which reference is made as a basis for the exercise of this power, refer entirely to the existing contract of the town with the plaintiff, and cannot be invoked as authority for the execution of a new and independent contract, binding upon the town, at the discretion of its agent."

Beware of Consciously Deviating from Your Contract!

A decision handed down by the Minnesota Supreme Court constitutes warning to contractors to stick to contract requirements. In the case before the Court—*Elliott vs. Caldwell*, 43 Minnesota Reports, 357—plaintiffs were denied right to recover for building a dwelling-house for defendant, because it was found that they deviated from their contract, without the owner's knowledge or assent, by substituting inferior materials and by defective work. The Court said:

"To justify a recovery upon the contract as substantially performed, the omissions or deviations must be the result of mistake or inadvertence, and not intentional, much less fraudulent; and they must be slight or susceptible of remedy, so that an allowance out of the contract price will give the other party substantially what he contracted for. They must not be substantial and running through the whole work, so as to be remediless, and defeat the object of having the work done in a particular manner."

And, concerning the right of a contractor to claim compensation for the reasonable value of work done in partial performance of a contract or under deviation from it, as distinguished from a suit for the contract price, the Court added:

"Such an action can only be maintained where a new contract may be implied from the conduct of the parties to pay a remuneration commensurate with the benefit derived from the partial performance; for an express contract necessarily excludes a contemporaneous implied one in relation to the same matter. The acceptance of the benefit of a partial performance, or of performance in a way different from that contracted for, where the party has the option of returning or rejecting the consideration performed, will usually be sufficient to imply a promise to pay a compensation commensurate with the benefit accepted. But the mere fact that a part-performance has been beneficial is not enough to render the party benefited liable to pay for the advantage. It must appear that he has taken the benefit under circumstances sufficient to raise an implied promise to pay for the work done, notwithstanding the non-performance of the special contract. Therefore, in a case of a building on land under a contract which the builder fails to complete, or which he completes in a manner not conforming to the contract, so that the owner cannot be charged with the contract price, the mere fact of the building remaining on the land, and that the owner resumed possession and enjoys the fruits of the labor, is not such an acceptance as alone will imply a promise to pay for it; for the possession of the land necessarily involves possession of the buildings in their existing state, and the owner has no option of rejecting them."

Structures Which Constitute "Scaffolds"

A statute requiring that scaffolds used in the construction of a building be such as to insure safety of persons working on or passing under them extends to sheathing boards laid on permanent joists in a building for use by bricklayers, according to the decision handed down lately by the St. Louis Court of Appeals in the case of *Carpenter vs. Burmeister*, 273 Southwestern Reporter, 418. The Court said:

"These sheathing boards, though subsequently to be used permanently, and though laid on permanent joists, merely constituted at that time a temporary scaffold for the bricklayers."

Requirements in Bidding for Public Work

Where a bidder for city building work failed to bid on additional items as required by the specifications and by statutory provision, he could not be regarded as the lowest bidder and an award to him was improper, declared the New York Supreme Court for Erie County in the late case of *Fraser vs. City of Buffalo*, 210 New York Supplement, 548. The Court observed:

"No one familiar with municipal or other specifications would have any reason to anticipate that the city authorities would treat their own positive specifications as mere surplusage. . . .

"A failure to conform to the requirement for separate bidding was not a mere irregularity, capable of being waived by the municipality, such as a failure to enclose a certified check with a bid. . . .

"This court is of course not concerned with an abuse of discretion in the awarding of contracts by the common council . . . where discretion rests in that body. Nor is it concerned in this action regarding any possible loss to the unsuccessful bidder, of which the plaintiff taxpayer is an officer. On the other hand, this plaintiff is an integral part of the taxpayers of the city of Buffalo, who are all vitally concerned in the maintenance of honest, upright, four-square competition in the bidding for municipal contracts. A municipality which acquires a reputation for loose specifications and unjust discrimination in the enforcement of specified requirements suffers financial loss in decreased competitive bidding, even though there be not the slightest evidence of fraud, collusion or dishonesty."

Effect of Arbitration Clause in Building Contract

A contract for the erection of houses contained this clause: "All questions that may arise under this contract and in the performance of the work thereunder shall be submitted to arbitration at the choice of either of the parties hereto." Holding that this provision did not apply to a claim on the part of the contractor for damages due to the owner preventing performance, the New York Court of Appeals said in the case of *Young vs. Crescent Development Company*, 148 Northeastern Reporter, 510:

"We know by common experience the class of questions to which this language naturally applies. It applies as stated to questions arising under and in the performance of a contract and such questions are those which involve an interpretation of its provisions for the purpose of determining whether work has been done according to the contract, whether work which has been demanded under the contract is really covered by its provisions or constitutes extra work, when payments become due, and so on. All of these questions involve recognition of the contract and not repudiation of it."

"This is not true of the claim under discussion. According to respondents' theory, the acts done by appellant [the owner] were not done under and in performance of the contract, but in violation of it and in repudiation of its provisions. There is involved no interpretation of its meaning, but a willful refusal to be bound by it, and, as it seems to me, this clause was intended to cover controversies which do not deny but seek an interpretation and submission to its provisions; an attitude which seeks action under the contract and not one outside of and in denial of it."

Contractor's Financial Statement

APPROVED AND RECOMMENDED FOR USE BY THE
JOINT CONFERENCE ON CONSTRUCTION PRACTICES

Submitted by.....
With principal office at.....
To.....

☐ An Individual
☐ A Co-partnership
☐ A Corporation

Condition at close of business.....19.....		Dollars				Cts.
ASSETS						
1. Cash: (a) On hand \$....., (b) In bank \$....., (c) Elsewhere \$.....						
2. Notes receivable (a) Due within 90 days.....						
(b) Due after 90 days.....						
(c) Past due.....						
3. Accounts receivable from completed contracts, exclusive of claims not approved for payment.....						
4. Sums earned on uncompleted contracts as shown by Engineer's or Architect's estimate.....						
(a) Amount receivable after deducting retainage.....						
(b) Retainage to date, due upon completion of contracts.....						
5. Accounts receivable from sources other than construction contracts.....						
6. Deposits for bids or other guarantees: (a) Recoverable within 90 days.....						
(b) Recoverable after 90 days.....						
7. Interest accrued on loans, securities, etc.....						
8. Real estate: (a) Used for business purposes.....						
(b) Not used for business purposes.....						
9. Stocks and bonds: (a) Listed—present market value.....						
(b) Unlisted—present value.....						
10. Materials in stock not included in Item 4 (a) For uncompleted contracts (present value).....						
(b) Other materials (present value).....						
11. Equipment, book value.....						
12. Furniture and fixtures, book value.....						
13. Other assets.....						
Total assets.....						
LIABILITIES						
1. Notes payable: (a) To banks regular.....						
(b) To banks for certified checks.....						
(c) To others for equipment obligations.....						
(d) To others exclusive of equipment obligations.....						
2. Accounts payable: (a) Not past due.....						
(b) Past due.....						
3. Real estate encumbrances.....						
4. Other liabilities.....						
5. Reserves.....						
6. Capital stock paid up: (a) Common.....						
(b) Common.....						
(c) Preferred.....						
(d) Preferred.....						
7. Surplus (net worth).....						
Total liabilities.....						
CONTINGENT LIABILITIES						
1. Liability on notes receivable, discounted or sold.....						
2. Liability on accounts receivable, pledged, assigned or sold.....						
3. Liability as bondsman.....						
4. Liability as guarantor on contracts or on accounts of others.....						
5. Other contingent liabilities.....						
Total contingent liabilities.....						

CONTRACTORS' & ENGINEERS' MONTHLY

DETAILS RELATIVE TO ASSETS

1	(a) on hand..... \$.....		
	Cash (b) deposited in banks named below.....		
	(c) elsewhere—(state where).....		
	NAME OF BANK	LOCATION	DEPOSIT IN NAME OF
			AMOUNT

2*	(a) due within 90 days..... \$.....			
	Notes receivable (b) due after 90 days.....			
	(c) past due.....			
	RECEIVABLE FROM: NAME AND ADDRESS	FOR WHAT	DATE OF MATURITY	HOW SECURED
				AMOUNT
Have any of the above been discounted or sold?.....If so, state amount, to whom, and reason.....				

3*	Accounts receivable from completed contracts exclusive of claims not approved for payment..... \$.....			
	NAME AND ADDRESS OF OWNER	NATURE OF CONTRACT	AMOUNT OF CONTRACT	AMOUNT RECEIVABLE
Have any of the above been assigned, sold, or pledged?.....If so, state amount, to whom, and reason.....				

4*	Sums earned on uncompleted contracts, as shown by engineer's or architect's estimate:..... \$.....					
	(a) Amount receivable after deducting retainage.....					
	(b) Retainage to date due upon completion of contract.....					
	DESIGNATION OF CONTRACT AND NAME AND ADDRESS OF OWNER	AMOUNT OF CONTRACT	AMOUNT EARNED	AMOUNT RECEIVED	RETAINAGE WHEN DUE	AMOUNT EXCLUSIVE OF RETAINAGE
					AMOUNT	
Have any of the above been sold, assigned, or pledged?.....If so, state amount, to whom, and reason.....						

* List separately each item amounting to 10 per cent or more of the total and combine the remainder.

DETAILS RELATIVE TO ASSETS (Continued)

5	Accounts receivable not from construction contracts..... \$.....		
	RECEIVABLE FROM: NAME AND ADDRESS	FOR WHAT	WHEN DUE
			AMOUNT
	What amount, if any, is past due..... \$.....		

6	Deposits with bids or otherwise as guarantees..... \$.....		
	DEPOSITED WITH: NAME AND ADDRESS	FOR WHAT	WHEN RECOVERABLE
			AMOUNT

7	Interest accrued on loans, securities, etc..... \$.....	
	ON WHAT ACCRUED	TO BE PAID WHEN
		AMOUNT

8	Real Estate : (a) Used for business purposes..... \$.....		
	Book value : (b) Not used for business purposes..... \$.....		
	DESCRIPTION OF PROPERTY	IMPROVEMENTS	
		NATURE OF IMPROVEMENTS	BOOK VALUE
			TOTAL BOOK VALUE
1			
2			
3			
4			
5			
6			
7			
	LOCATION	HELD IN WHOSE NAME	ASSESSED VALUE
			AMOUNT OF ENCUMBRANCES
1			
2			
3			
4			
5			
6			
7			

List separately each item amounting to 10 per cent or more of the total and combine the remainder.

DETAILS RELATIVE TO ASSETS (Continued)

12	Furniture and fixtures at book value.....	\$.....
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13	Other assets.....	\$.....
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DESCRIPTION	AMOUNT

TOTAL ASSETS \$

DETAILS RELATIVE TO LIABILITIES

1	Notes payable	(a) To banks, regular..... (b) To banks for certified checks..... (c) To others for equipment obligations..... (d) To others exclusive of equipment obligations.....	\$..... \$..... \$..... \$.....
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TO WHOM: NAME AND ADDRESS	WHAT SECURITY	WHEN DUE	AMOUNT

2	Accounts payable	(a) Not past due..... (b) Past due.....	\$..... \$.....
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TO WHOM: NAME AND ADDRESS	FOR WHAT	DATE PAYABLE	AMOUNT

3	Real estate encumbrances (See Item 8, Assets).....	\$.....
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4	Other liabilities.....	\$.....
----------	------------------------	---------

DESCRIPTION	AMOUNT

5	Reserves.....	\$.....
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INTEREST	INSURANCE	BLDGs. & FIXT.	PLANT DEPR.	TAXES	BAD DEBTS		
\$.....	\$.....	\$.....	\$.....	\$.....	\$.....	\$.....	\$.....

6	Capital stock paid up	(a) Common..... (b) Preferred.....	\$..... \$.....
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7	Surplus.....	\$.....
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TOTAL LIABILITIES \$

If a corporation, answer this:

Capital paid in cash, \$.....
 When incorporated.....
 In what State.....
 President's name.....
 Vice-President's name.....
 Secretary's name.....
 Treasurer's name.....

If a co-partnership, answer this:

Date of organization.....
 State whether partnership is general, limited or association.....

Name and address of partners:	Age

The undersigned hereby declares: that the foregoing is a true statement of the financial condition of the individual, co-partnership or corporation herein first named, as of the date herein first given; that this statement is for the express purpose of inducing the party to whom it is submitted to award the submitter a contract; and that any depository, vendor or other agency herein named is hereby authorized to supply such party with any information necessary to verify this statement.

NOTE: A co-partnership must give firm name and signatures of all partners. A corporation must give full corporate name, signature of official and affix corporate seal.

Affidavit for Individual

STATE OF.....
 COUNTY OF..... } ss.:

.....being duly sworn, deposes and says that the foregoing financial statement, taken from his books, is a true and accurate statement of his financial condition as of the date thereof and that the answers to the foregoing interrogatories are true.

Sworn to before me this.....
 day of.....19.....
 Notary Public

(Applicant must also sign here)

Affidavit for Co-partnership

STATE OF.....
 COUNTY OF..... } ss.:

.....being duly sworn, deposes and says that he is a member of the firm of.....; that he is familiar with the books of the said firm showing its financial condition; that the foregoing financial statement, taken from the books of the said firm, is a true and accurate statement of the financial condition of the said firm as of the date thereof and that the answers to the foregoing interrogatories are true.

Sworn to before me this.....
 day of.....19.....
 Notary Public

(Members of firm must also sign here)

Affidavit for Corporation

STATE OF.....
 COUNTY OF..... } ss.:

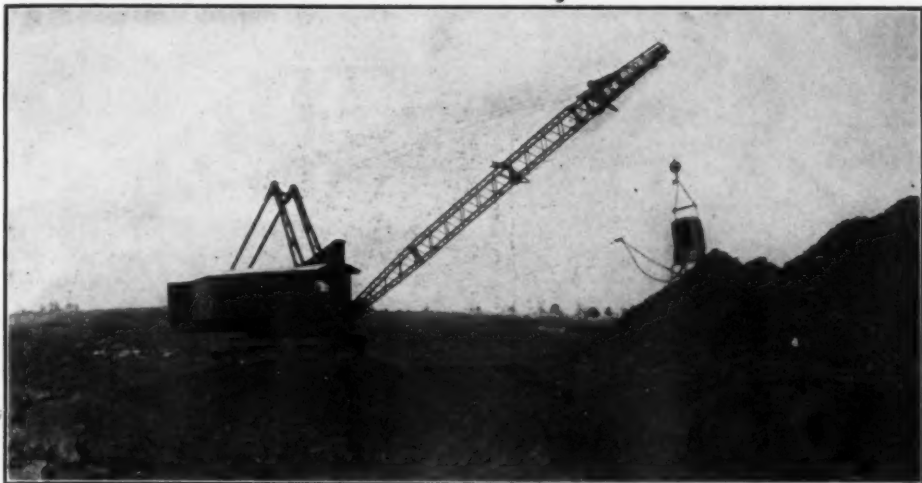
.....being duly sworn, deposes and says that he is.....of the.....the corporation described in and which executed the foregoing statement; that he is familiar with the books of the said corporation showing its financial condition; that the foregoing financial statement, taken from the books of the said corporation, is a true and accurate statement of the financial condition of the said corporation as of the date thereof and that the answers to the foregoing interrogatories are true.

Sworn to before me this.....
 day of.....19.....
 Notary Public

(Officer must also sign here)

Construction of the Garza Reservoir Dam

New Unit for Dallas, Texas, Water-Works, R. A. Thompson, Consulting Engineer



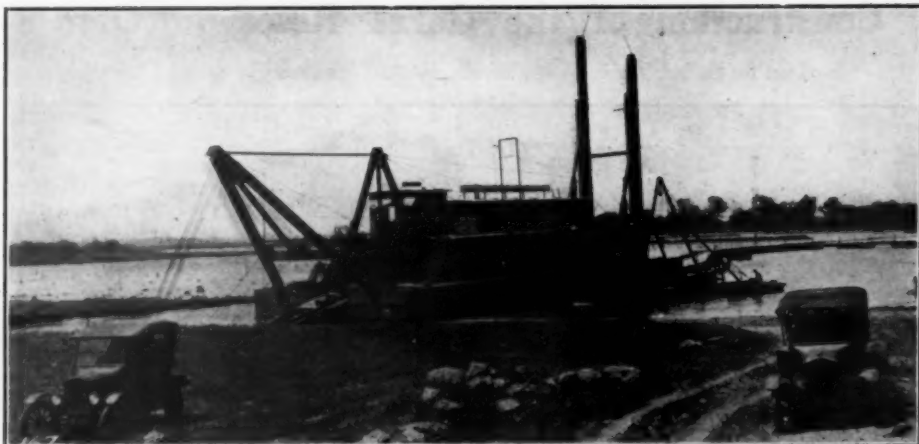
EXCAVATING CORE TRENCH OF GARZA DAM WITH DRAG-LINE

Core trench of the entire dam was excavated with a Bucyrus Class-24 drag-line having a 5-cubic-yard bucket and a 100-foot boom. The drag-line is electrically operated with a 225-horse-power motor. The main part of the trench across the valley is 3,500 feet long, 12 feet wide at the bottom, with side slopes of 1 to 1 and varies from 20 to 30 feet deep. It is excavated to ground-water or river-bed level. The trench excavation for the entire dam when completed will amount to 288,000 cubic yards



DRIVING STEEL SHEET PILING IN CORE TRENCH

For a distance of 3,500 feet where the core trench excavation did not reach to hard clay or shale, interlocking steel sheet piling was driven through the alluvial material to the underlying stratified beds. Carnegie section M-104 was used in lengths varying from 14 to 45 feet and weighing 35 pounds per square foot. A total of 2,121 tons of piling was driven. Usually it was driven to actual refusal, but from 6 to 8 feet was permitted to stick up from the bottom of the trench for encasement later in the puddled backfilling. The piling was driven with especially constructed steel frame drivers using a 6,500-pound No. 2 Vulcan steam-hammer which was carried about 15 feet above the river-bed level to avoid delays in case of high water



HYDRAULIC SUCTION DREDGE USED FOR HYDRAULIC FILL

The entire embankment of the dam, which will contain more than 2,000,000 cubic yards, is a hydraulic fill. It is now being placed with a 20-inch electrically operated suction dredge which is 115 feet long, 45 feet wide and 11 feet deep and which was built on the site of the dam mostly out of Oregon fir timber. The spuds are single pieces 26 inches square by 70 feet long. Steel stiffening trusses were used in the hull to prevent vibration and settlement of the machinery. This 20-inch dredge is operated with a 1,600-horse-power 2,300-volt alternating-current motor to which it is direct connected. More than 6,000 feet of steel-welded pipe is used to convey the material excavated with the pump onto the dam. The pipe is No. 10-gage high-carbon steel made by the Wyatt Metal and Boiler Works of Dallas, Tex. The dredge was built and is operated by the Puget Sound Bridge and Dredging Company, which has the contract for the dam embankment.



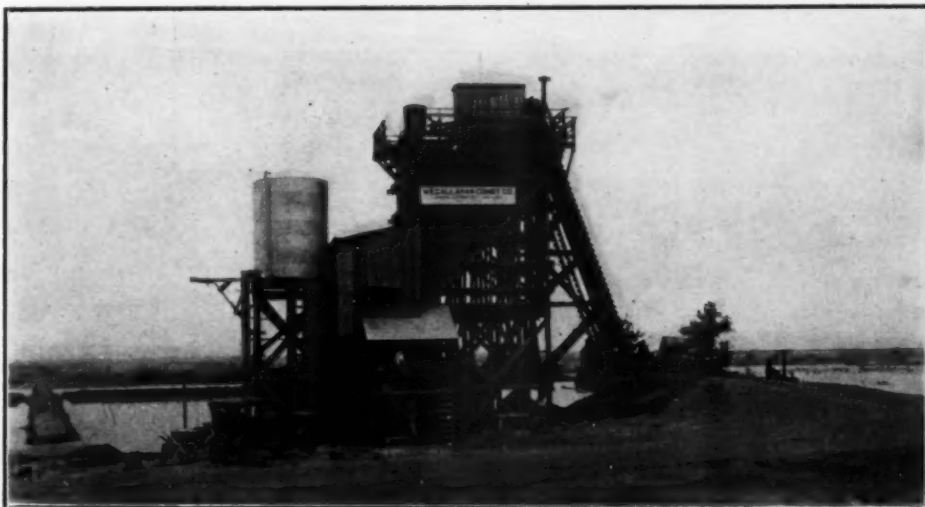
END OF DISCHARGE PIPE OF SUCTION DREDGE

The borrow pit above the dam from which the embankment material is pumped by the dredge contains stiff alluvial clay with occasional sand strata and pockets of gravel. This clay is difficult to excavate with the ordinary type of cutter head and it has been necessary to design specially shaped heads properly to handle the material. The clay frequently discharges from the pipe onto the dam in balls of from $\frac{1}{2}$ to 10 inches in diameter. These subsequently melt and fuse into the mass of the dam, and make a most excellent material for an impervious structure. The elevation of the water in the core pool shown in the upper left is regulated by a controlled outlet. The relative elevation of the end of the discharge pipe in the core pool fixes the line between the coarse material in the outer sections and the fine puddled material in the core; that is, the coarser material takes a certain slope from the dredge pipe to the water's edge in the core pool and stops when the deeper water is reached because there is no velocity to carry it further. The water in the pool moves very slowly towards the spillway provided for it, giving the very fine sand and clay carried in suspension, ample time to settle. A very thin section of this puddled clay extending up through the dam would make it impervious to leakage, but for practical reasons it is found advisable to make the puddled core of a width about the same as the height of the dam above; that is, if the dam is 80 feet high, the puddled core would run from 80 feet wide at the bottom to 12 feet wide at a point about 12 feet below the top. With the ordinary dam, only 25 to 30 feet wide on top, it is not practical under the hydraulic method to carry a good core closer than 10 to 12 feet from the top.



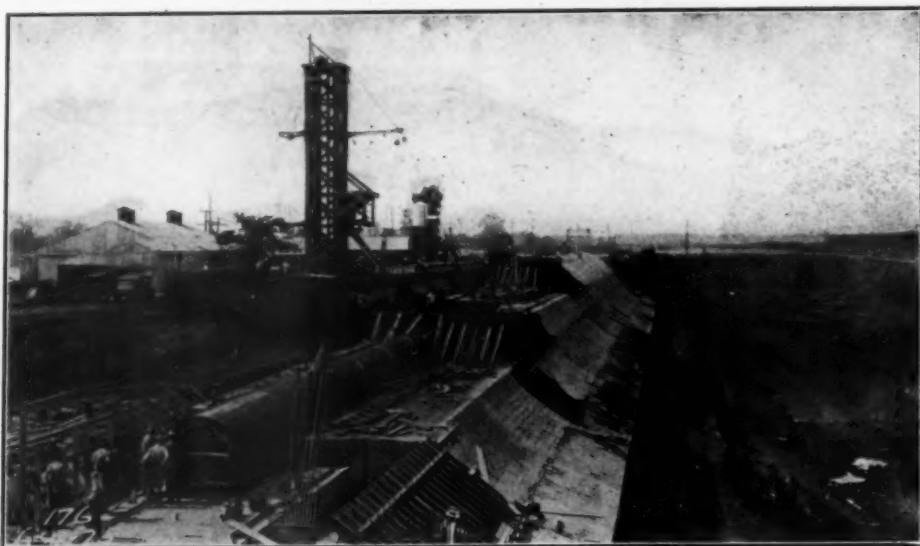
THE DAM EMBANKMENT UNDER CONSTRUCTION

The embankment of the Garza dam is being built of alluvial material which is discharged along the outer edges where the gravel and coarser sediment remains, the fine silt going to the center and depositing in the core pool which is always maintained. The excess water from the pipe is carried off through a spillway at the farther end of the dam. The embankment is brought up and levees maintained on the sides with two P & H gasoline-operated drag-line machines, one of which is seen working in the center of the picture. The top of the embankment shown in the foreground will be about 30 feet higher than at present when completed. A gap about 1,000 feet long has been left between the present end of the dam and the hill which appears in the background, through which floods will be passed until the completion of the remainder of the structure to grade. Such flood water as comes while the gap is being closed will be passed through the conduits. A small flood of about 6,000 cu. ft. per second was passing through the gap at the time this photo was taken. The transformers required for reducing the electric current used in the machines and camps from 60,000 volts to 2,300 volts are shown in the right foreground. Smaller transformers are used to reduce the 2,300-volt current to 440 volts for the big drag-line and to lower voltages for the concrete mixers, water-supply and camp lighting. About one million kw. hrs. are used each month.



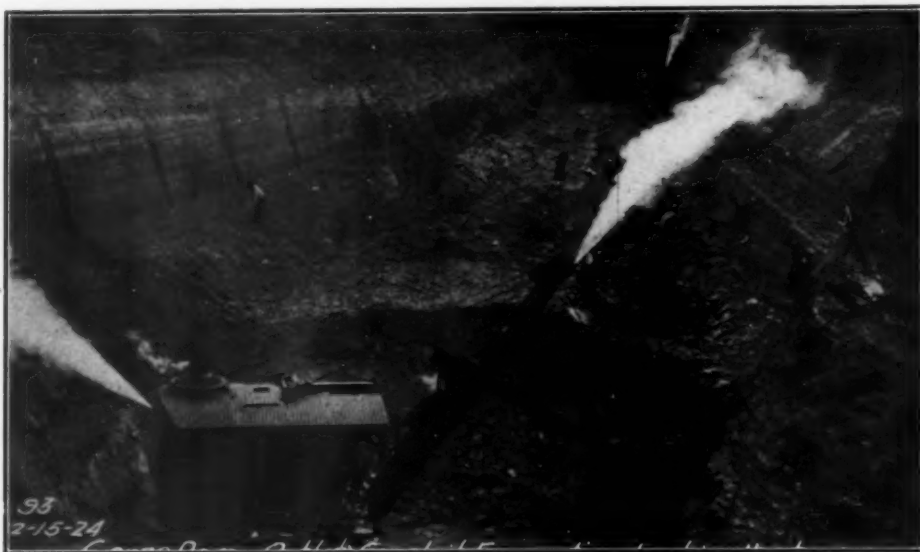
THE CENTRAL MIXING PLANT OF THE W. E. CALLAHAN CONSTRUCTION COMPANY

The concrete for the conduits and spillway, which will amount to about 20,000 cubic yards, is being mixed at a central plant located midway between these structures. The aggregate is hauled from gravel pits located about 1 1/2 miles away in trucks and dumped into a hopper from which it is elevated by bucket conveyors to screens on top of the plant. The gravel and sand are separated and each is stored in bins just above the mixer for later use. The concrete is delivered from the mixer to the structure in one-yard steel hopper cars which are operated on a 24-inch-gage track and drawn by Fordson tractors in 3- and 4-car trains. The one-cubic-yard Austin cube-type mixer is electrically operated. Cement is delivered in cars to the cement house located directly behind the mixer. The working capacity of the plant is about 400 cubic yards of concrete in 10 hours. The batches are held in the mixer not less than one minute and average about 30 cubic feet each.



CONSTRUCTION OF THE 560-FOOT CONCRETE SPILLWAY

On the high ground south of the river channel a concrete spillway of the O. G. gravity-type section is being built, with its crest 65 feet above the level of the apron floor which is at the elevation of the river bed. The apron will be protected at the lower side with a toe-wall carried 10 feet into the shale. The main body of the spillway varies from 20 to 25 feet in height and rests directly upon the hard blue shale which underlies generally the entire foundation of the dam. The slab connecting the main body with the apron is 4 feet thick and is laid on a slope of $2\frac{3}{4}$ to 1 at the top and decreasing to $1\frac{1}{4}$ to 1 at the bottom. Lines of 6-inch tile are being laid horizontally under the slab at 7-foot intervals for drainage. Short sections of 3-inch iron pipe connect through the floor of the apron with gravel pockets underneath for the same purpose. The spillway when completed will contain about 2,400 cubic yards of concrete and require more than 230,000 cubic yards of excavation. A 6 x 7-foot tunnel is carried from end to end through the main section. The main county highway will be carried over the top of the spillway on four 139-foot steel spans.



EXCAVATING FOR THE OUTLET CONDUITS

The material in the excavation for the outlet conduits was a firm sandy shale which required heavy shooting before removal. It stood well, however, under weathering on steep slopes and the concrete was placed directly against it without forms. The excavation was removed by two Erie oil-burning steam shovels having $1\frac{1}{2}$ -cubic-yard dippers. The material was hauled from the shovels in 3-up dump-wagons and placed in the toes of the dam across the river, from 300 to 1,000 feet away.



GARZA DAM OUTLET CONDUIT LOOKING UP-STREAM

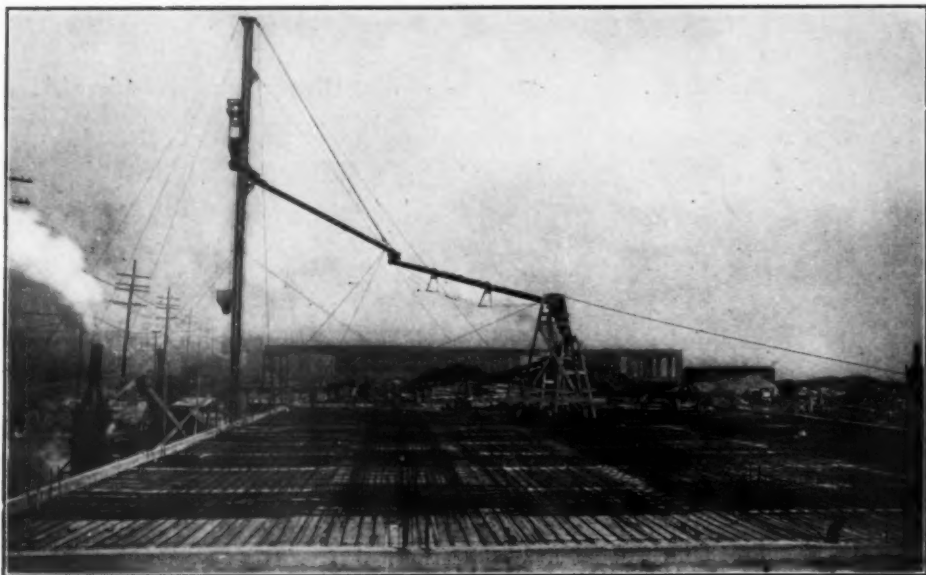
To handle the flood water during the construction period and subsequently to pass the water from the reservoir down the river channel to the settling basins and filtration plant of the city of Dallas, 25 miles below, two oval-shaped concrete barrels have been built under the dam in the bank just south of the river channel. Here most excellent foundation material was found for this important structure. The conduits are 485 feet long between head-walls and have a major (vertical) diameter of 19 feet and a minor (horizontal) diameter of 14 feet. Under a 44-foot head they will discharge 12,000 second-feet of water, which approximates the flow of the stream under ordinary flood conditions. The conduits were so designed that no reinforcing steel was necessary to carry the dam above after its completion. However, in order to provide against certain extraordinary stresses which might occur during the construction of the hydraulic fill, thereby present in unbalanced conditions, considerable steel was actually placed in the concrete. The arch forms were built in 15-foot sections with construction joints 30 feet apart. These forms were lowered onto greased skids bolted to the side walls of the conduits for moving ahead.



OUTLET CONDUITS IN GARZA DAM LOOKING DOWN-STREAM

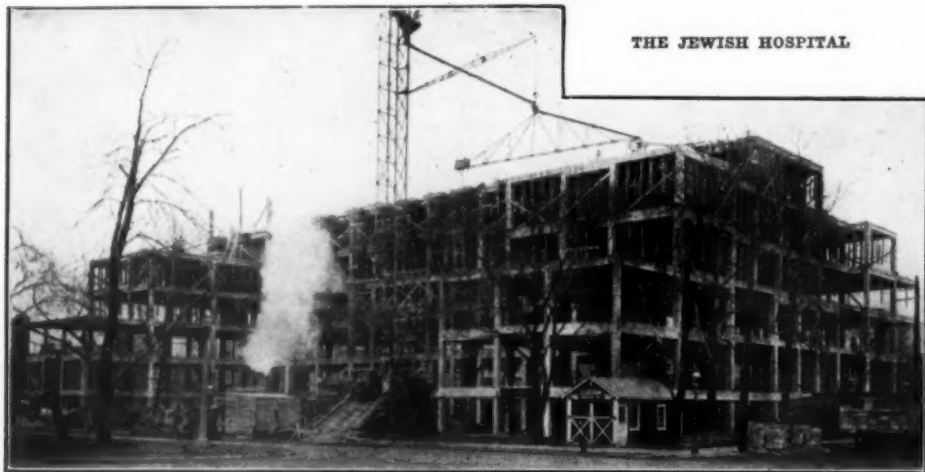
After the dam is completed the conduits will be closed with concrete plugs except that two lines of 48-inch cast iron pipe with two gate valves in each line will be installed in each barrel, and an 18-inch line and valve in one barrel to pass the water for normal use. The valves will be operated from a gate-house on the top of the dam. The conduits contain 4,800 cubic yards of concrete and required 54,000 cubic yards of excavation.

Interesting St. Louis Jobs



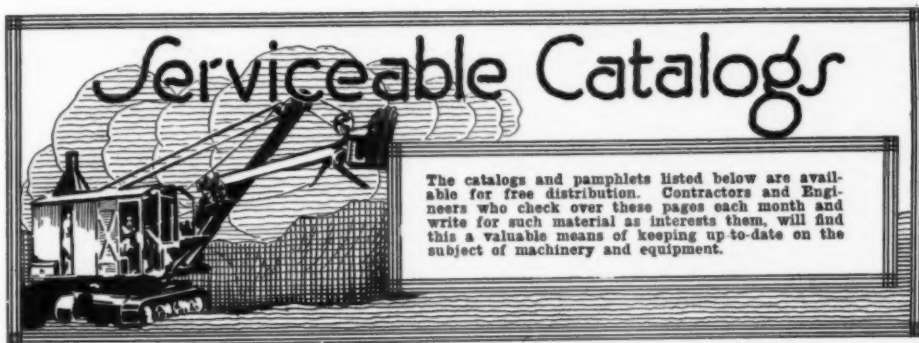
CONSTRUCTION OF THE MORE-JONES BRASS COMPANY BUILDING, ST. LOUIS, MO.

The Insley steel $\frac{1}{2}$ -yard mast boom plant used by the Fruin-Colnon Contracting Company, Merchants-Laclede Bank Building, St. Louis, Mo., who are the general contractors on this job, was purchased from The Geo. F. Smith Company, St. Louis. This photograph was taken in March, 1925



THE JEWISH HOSPITAL

The contractors used on this job one 221-foot height Insley steel tower quick-shift counterweight chuting plant, one $8\frac{1}{4}$ x 10 double-drum, double-cylinder Clyde steam hoisting engine, one 21-S Smith tilting mixer on skids with batch hopper, one No. 30 Blaw-Knox sand batcher, and one No. 40 Blaw-Knox stone batcher. All this equipment was rented by the Geo. F. Smith Company, St. Louis, Mo., to the Murch Brothers Construction Company. It is seldom that construction equipment distributors rent as complete or elaborate a plant as this. The contractor sunk his tower and mixer 30 feet in the ground and built over it a large bin with a ramp leading up to the bin, which was fed by motor trucks. The Blaw-Knox measuring batchers were used for proportioning the material for each batch, and these batches in turn fed into the batch hopper of the mixer, the batch hopper feeding, of course, into the mixer itself. The plant proved very efficient and effected economies in operation which could not have been secured in any other manner. Murch Brothers put this job up in record time and used 3,000 Roeshors



The catalogs and pamphlets listed below are available for free distribution. Contractors and Engineers who check over these pages each month and write for such material as interests them, will find this a valuable means of keeping up-to-date on the subject of machinery and equipment.

DRIVING PILES 40 FEET UNDER WATER

A new catalog of the McKiernan-Terry Drill Co., 19 Park Row, New York City, not only describes and illustrates the use of McKiernan-Terry steam pile hammers for under-water service, but gives helpful figures on many other kinds of pile-driving jobs.

A WELL-BUILT ROAD BUILDER AND MAINTAINER

The Monarch Cub Roller is a piece of road-building equipment with a broad field of usefulness in hauling materials, scarifying, grading, and in leveling. This machine, which is more than "just another small roller," is described fully in a folder which may be secured from the Good Roads Machinery Co., Inc., Kennett Square, Pa.

A COMPLETE CATALOG OF ROAD-BUILDING MACHINERY

Catalog No. 47 which has been issued by the C. D. Edwards Mfg. Co., Inc., Albert Lee, Minn., describes its seven sizes of road graders, Fordson maintainers, rotary snow-plows, Fresno scrapers, slip scrapers, road-draws, wheel scrapers, road plows, road routers, culverts, intake grates and other equipment for road work.

ENGINES THAT SPEED UP CONTRACTS

According to the manufacturers, increased production comes easily when contracting equipment has Alamo power. The Alamo Engine Co., Hillsdale, Mich., will be glad to have contractors write them direct regarding power problems and will be pleased to send help and literature on request.

ROAD-BUILDING TRACTORS

The Rumely OilPull road-building tractor, built by a company that has been building quality machinery for over 80 years, is described in a completely illustrated 16-page catalog which may be secured on request from the Advance-Rumely Thresher Co., Inc., La Porte, Ind.

ASPHALT PAVING TOOLS

Littleford asphalt paving tools of the good kind include tamper, smoothers, asphalt rakes, asphalt shovels, picks, cutters, squeegees, push-brooms, hand dippers, pouring pots, tool-heaters, etc., and are described fully in the literature of Littleford Brothers, 485 E. Pearl St., Cincinnati, Ohio.

POWER-PLANTS FOR HARD SERVICE

Turno industrial power-plants, built as 8-, 15-, 25- and 35-horse-power units, are constructed for hard, continuous usage on contractors' equipment. They are described in the literature of the Turner & Moore Mfg. Co., 4660 Merritt Ave., Detroit, Mich.

A NEW 20-TON GASOLINE LOCOMOTIVE

To meet the prevailing demands for heavier gasoline locomotives, the Vulcan Iron Works, Wilkes-Barre, Pa., has recently developed the new 20-ton machine to be known as their model HS-20. This unit is fully described in the latest literature issued by this company.

ELECTRIC LIGHTING OUTFIT FOR CONTRACTORS

Electric lighting outfits for excavating machinery and contractors' equipment as well as for small construction camps are described in Bulletin S-90 which may be secured from Bradlee Van Brunt, the Bucyrus Co., South Milwaukee, Wis.

HIGH-CAPACITY PORTABLE AIR-COMPRESSORS

The O. K. Clutch & Machinery Co., Columbia, Pa., in its latest bulletin, describes the complete line of O. K. portable air-compressors, both gasoline- and electric-driven, in capacities of 118 to 260 cubic feet of air per minute.

A NEW LINE OF TWO-CYLINDER GASOLINE ENGINES

The Fuller & Johnson Mfg. Co., Madison, Wis., has issued a very comprehensive bulletin illustrating and describing its new Model AB 2-cylinder gas engines in detail. The bulletin will be gladly sent to interested parties upon request.

PORTABLE PUMPS ATTACHED TO AUTOS

The Barton portable pump which is attached to the front of any motor truck, auto or tractor, always remains in position, being ready for use, thus saving much time in getting set on the job. Bulletin 56 issued by the American Steam Pump Co., Battle Creek, Mich., describes this effective unit.

HOISTING BLOCKS

Star-brand hoisting blocks which are always reliable and made for every condition of service, are described in the literature of the Boston & Lockport Block Co., East Boston, Mass.

THE BEST IN ROAD ROLLERS

No matter what type of road roller you may desire, you will find it described completely with valuable working data in catalog A which is issued by the Buffalo Springfield Roller Co., Springfield, Ohio.

DERRICKS AND WINCHES

A complete catalog, No. 22, has been issued by the Dobbie Foundry & Machine Co., Niagara Falls, N. Y., illustrating and describing Dobbie derricks and winches, a complete stock of fittings for which are on hand at all times.

HOW TO CURE CONCRETE

This is the title of a very well-prepared book which describes curing methods for concrete, using Dowflake, and also gives many pages of engineering tables and data. It may be secured free from the Dow Chemical Co., Midland, Mich.

ONE MAN CAN MOVE DIRT EFFECTIVELY

The Miami Trailer-Scraper Co., Troy, Ohio, has issued a very interesting broadside folder showing how the Miami scraper unit with a Fordson tractor moves more dirt in less time than with four teams and six men. "Dirt Moving Costs" is a folder which contains analytical costs that will surprise you.

TRACTOR-DRAWN SELF-LOADING SCRAPERS

A new illustrated catalog, No. 209-A, has recently been issued by the Baker Mfg. Co., 585 Stanford Ave., Springfield, Ill., describing Baker-Maney self-loading scrapers in tractor-drawn models which are so effective in reducing grading and general dirt-moving costs.

A DITCHER FOR CURB AND GUTTER WORK

The Clinton flat-bottom ditcher developed and sold by Clinton & Held Co., 1501-1511 Waseco St., Denver, Colo., has many features of particular interest to the contractor engaged in curb and gutter work, as it readily removes the dirt and makes the placing of forms particularly easy.

ALL-STEEL DUMP-TRUCK BODIES

Herr all-steel side-dump bodies for Ford trucks and other makes are revolutionizing the handling of road materials, as there is no backing up, no jockeying for position and no delay. These bodies are described in the literature of the Herr Dump Car Mfg. Co., Coatesville, Pa.

MACHINE-MADE CONCRETE PIPE

The literature of the Newark Concrete Pipe Co., 462 Broad St., Newark, N. J., describes this company's reinforced concrete pipe for sewer, culverts, pressure and subaqueous work, as well as machine-made concrete pipe, concrete brick and concrete building tile.

ROCK DRILLS THAT PERMIT CLOSER BIDDING

You can bid closer than the other fellow on any rock excavation job if you standardize on Waugh drills, according to the Denver Rock Drill Mfg. Co., Denver, Colo., which will be pleased to send a complete catalog describing Waugh drill sharpeners, hoists and portable compressors.

STANDARD FORD TRUCK BODIES

Ford 1-ton truck chassis with standard Ford stake bodies and all-steel enclosed cabs which are scientifically designed and well-constructed, offering the maximum carrying space for one-ton trucks, are described in the latest literature of the Ford Motor Co., Detroit, Mich.

EFFICIENT HAULING—MORE TON-MILES PER DOLLAR

The efficiency of motor truck transportation is measured in ton-miles per dollar. The contractor is interested in the sturdiness of the truck, its economy of operation and its lasting qualities. All of these attributes of a satisfactory truck with regard to GMC units are described in the literature of the General Motors Truck Co., Pontiac, Mich.

PROTECT YOUR WATER-METERS

Ford meter-box equipment provides ideal water-meter setting, giving perfect protection from frost, fire, hot water, tampering and damage from any source. These boxes are described in the catalog of the Ford Meter Box Co., Wabash, Ind.

WELL-BUILT CONCRETE MIXERS

Panama concrete mixers, which can be depended upon to give the greatest degree of satisfactory service and at the same time speed up production and cut costs, are described in the complete catalog of the J. B. Foote Foundry Co., 32 Front St., Fredericktown, Ohio.

WELDED FABRIC REINFORCEMENT FOR CONCRETE

The latest literature of the Wickwire-Spencer Steel Co., Inc., 41 East 42nd St., New York City, describes the many uses and the value of Clinton welded fabric for the reinforcement of concrete bridges, buildings, docks, flumes, grandstands, levees, pipes, reservoirs, roads, sewers, subways and viaducts.

CHAMPION GRAB BUCKETS

Type W grab buckets which are all-round champions, fast as lightweights, yet packing a Dempsey punch, built both for rehandling and excavating, are described in catalog No. 23 issued by the Mead-Morrison Mfg. Co., 1048 Prescott St., East Boston, Mass.

A CONCRETE SURFACER AND FINISHER

The Berg electrically operated concrete surfer and finisher, which is a light, portable machine, readily carried around by any workman, and which is used on buildings, bridges, walls, culverts, dams, foundations, monuments, etc., is described in literature which may be secured from the Concrete Surfacing Machinery Co., Dept. F, 4669 Spring Grove Ave., Cincinnati, Ohio.

QUALITY-MADE CARS AND TRUCKS

Contractors are sometimes deluded by shaved prices into buying cars and trucks that are worth only their value in junk. Koppel cars and trucks are made to do your work well and are second to none. They are described completely in literature which may be secured from the Koppel Industrial Car & Equipment Co., Koppel, Pa.

SAFE PRACTICES IN OXYACETYLENE WELDING AND CUTTING

Copies of a well-prepared pamphlet on precautions and safe practices in oxyacetylene welding and cutting may be obtained by contractors interested in this economical means of fabricating and repairing structural steel, iron and cast iron, from the Oxweld-Acetylene Co., 30 E. 42nd St., New York City.

LOWER YOUR LOADING COSTS

The Barber-Greene bucket loader is built to load any loose material and load it fast. It has a hunky frame and safety overload features. Twenty different uses of this outfit are illustrated by actual job pictures and data in a new booklet, "Contracting with Barber-Greene," which may be secured from the Barber-Greene Co., 485 W. Park Ave., Aurora, Ill.

ADD POWER AND SPEED TO BACKFILLING JOBS

Grid-Iron-Grip wheels embodying the crawler principle give a light tractor extra draw-bar pull and traction that makes it possible to do really heavy jobs without a reduction in the tractor speed. The latest literature of the Tractor Grip Wheel Co., 2248 War Works Drive, Toledo, Ohio, describes Grid-Iron-Grip wheels for Fordsons and International tractors.

RAPID CHARGING AND DISCHARGING MIXERS

The Wonder 14-1925 Model requires 10 seconds to charge and 5 seconds to discharge. This improvement in the well-known Wonder concrete mixer is accomplished without sacrificing mixing time as told in the literature of the Construction Machinery Co., Waterloo, Iowa.

A NEW HOISTING MACHINERY CATALOG

The S. Flory Mfg. Co., Bangor, Pa., in its new catalog No. 31, describes Flory steam, electric, gasoline and belt-driven hoisting machinery for construction and material-handling operations.

A ONE-MAN GRADER WITH POWER LIFT

The new Acme-Fordson grader with power lift for general dirt and gravel road maintenance work and snow removal is a unit well worth examining. A complete description of this unit may be secured from the Acme Road Machinery Co., Frankfort, N. Y.

A PAVING FILLER FOR BRICK AND BLOCK PAVEMENTS

The Asphalt Sales-Dept., the Texas Co., 17 Battery Place, New York City, has issued a well-illustrated, practical 32-page booklet on Texaco paving filler for vitrified brick and block pavements, which should be in the hands of municipal officials and contractors engaged in the laying of these types of pavement.

AN ILLUSTRATED DIARY OF ONE MONTH'S WORK

The Universal Crane Co., 914 Swetland Bldg., Cleveland, Ohio, has issued a very interesting illustrated diary showing the fifteen jobs handled by one Universal crane during one month, giving pertinent data on each job.

A STEAM SHOVEL BUILT FOR HARD KNOCKS

In an interesting new folder, "Four Hundred Pounds of Dynamite Didn't Stop It," the Osgood Co., Marion, Ohio, tells a lot about the stamina of power shovels and gives a particular instance of an Osgood which struck 400 pounds of unexploded dynamite and came through whole except for a few minor repairs.

A NEW PORTABLE CRANE FOR LIGHT TRUCKS

The International Motor Co., 25 Broadway, New York City, has developed a motor-operated portable crane for mounting on 1½- to 2½-ton-Mack trucks, which will be of interest to municipal officials and contractors who realize the value of a portable truck crane.

A 150-PAGE CONTRACTORS' CATALOG

The complete 150-page C. H. & E. catalog lists a large number of saw rigs, diaphragm pumps, piston pumps, centrifugal pumps, triplex pumps, reversible hoists, single-acting hoists, double-drum hoists, mortar mixers, double- and single-cage elevators. This can be secured free from the C. H. & E. Manufacturing Co., Clinton and Mineral Sts., Milwaukee, Wis.

EXPLOSIVES AND THE USES TO WHICH THEY ARE ADAPTED

A bulletin entitled "Brands of Du Pont Explosives and the Uses to Which They are Adapted" has just been issued by the Explosives Dept., E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., for the purpose of aiding users of explosives to avoid the purchase of unsuitable explosives and to help them select those which will give the best results in proportion to cost.

A NEW PORTABLE PUMPER

The new Jaeger pumper for mounting on the front of Ford trucks, and operating from the Ford engine, adaptable to all types of emergency work, such as pumping out trenches, basements, caissons, ditches, etc., after heavy rains or floods and serviceable for small-town flushing and sprinkling units, is described in full in the literature of the Jaeger Portable Machinery Co., Woodbridge at Rivard, Detroit, Mich.

POWER-SHOVELS WITH SPEED AND STAMINA

P & H power-shovels which load trucks on the top of the bank, thus quickly cleaning up the work, and which have the proper dipper stick design and control, are described in Bulletin 82-X which may be secured from the Harnischfeger Corp., successor to Paving & Harnischfeger Co., 3819 National Ave., Milwaukee, Wis.

STRONG, LIGHT, SPEEDY CRANES

The Whippet line of Speeder cranes, which are light, fast, and strong, and equipped with a half-yard shovel or clam-shell bucket, are described in the latest illustrated catalog of the Speeder Machinery Corp., Fairfield, Iowa.

ALUMINUM RULE GRADUATED DECIMALLY

The new Lufkin aluminum folding rule, which is graduated in tenths and hundredths of feet on one side and in feet, inches and sixteenth-inches on the other, is described in literature which may be secured from the Lufkin Rule Co., Saginaw, Mich.

COLLAPSIBLE HORSES SAVE MONEY

The Taylor Collapsible horse, which is taken apart when not in use, costs less than the ordinary horse, and when collapsed takes up no more space, is described in a folder which may be secured from the Taylor Collapsible Horse Co., 730 West Harrison St., Chicago, Ill.

A SPEEDY, ECONOMICAL POWER SHOVEL

The Byers Bear Cat with shovel attachment, because of its speed, economy, versatility and reasonable first cost is said to be the machine for 9 out of 10 contractors. It is described in detail in the literature of the Byers Machine Co., 480 Sycamore St., Ravenna, Ohio.

WHEELBARROWS BUILT FOR SPECIFIC SERVICE

The Wolverine F-3, a popular wheelbarrow for high-grade construction work, having a tray pressed from a single sheet of steel, handles mounted at the proper height, and extra-heavy wheels with steel bushings, is described in a book, "Lansing Equipment for Contractors," issued by the Lansing Co., Lansing, Mich.

THE IRRESPONSIBLE BIDDER

An interesting booklet entitled "The Irresponsible Bidder," which gives a digest of the prevailing unsatisfactory conditions in the engineering-contracting industry, has been published by Warren Brothers Co., 9 Cambridge St., Boston, Mass., and will be sent free to any one interested.

A CAST IRON PIPE HANDBOOK

The 1925 Cast Iron Pipe Handbook, issued by the United States Cast Iron Pipe & Foundry Co., Burlington, N. J., is a very full and handy volume containing, in addition to the complete listing of standard pipe and fitting data, chapters on cast iron pipe trade customs, centrifugally cast iron pipe, and other features. This book may be secured by writing to John D. Capron, Publicity Manager.

Mechanical Equipment for the Inundation Method

A Method, Previously Discussed, Making for More Accurate Measurements of Sand for Concrete

THE subject of better concrete is of vital importance. "Constant concrete" may be defined as concrete the properties of which are so uniform in quality and strength that it may be considered as possessing all the good attributes of an unvarying material. In the past, concrete has not been uniform. It is evident that unless the strength of concrete can be forecast and obtained within fairly close limits, high factors of safety must be used to safeguard against low strength.

In common with so many other important materials, concrete has not escaped rigid and scientific investigations. Such investigations have revealed the fact that constant concrete is possible. In the laboratory under ideal conditions where the nature of the ingredients can be carefully investigated and correct proportions determined, concrete can be produced the strength of which may be forecast to a reasonably close degree. In such laboratory work, stone and sand are first carefully dried, and in such condition can be accurately measured. In the field, however, it is evident that laboratory conditions cannot be established, and so an equalizing system must be adopted whereby inconsistencies in the aggregate can be automatically overcome so that not only is the first batch exactly according to specifications, but each succeeding batch is identical.

Constant Concrete Now Possible in the Field

The mechanical equipment which forms the necessary link between sand, stone, cement, and water and the mixing process and which does the very thing which it is desired to accomplish, that is, removes variables from the aggregate and produces constant concrete, has been developed by the Blaw-Knox Company, Pittsburgh, Pa., in its inundation method equipment. This method and the equipment used in it present a practical remedy for the bulking of sand due to a variable moisture content. The remedy is based on the principle that when sand, regardless of the degree of dampness which it contains, is submerged or inundated, the bulking effect due to such dampness ceases and the sand settles to a uniform compactness in the water. Once the sand is thus inundated, the amount of water held by the sand previous to its inundation is of no further importance. The voids of the sand are filled. This amount is constant and cannot vary.

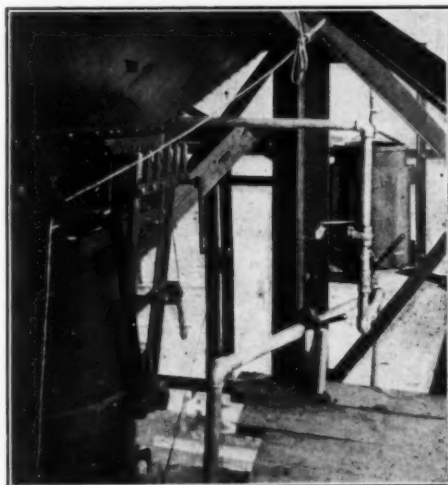
The Blaw-Knox inundation method consists of an inundator or self-dumping and righting steel container with an adjustable bottom, a shaker or sand sifter, a strike-off gate, and an excess-water measuring tank and water chamber. The inundator is mounted on a trunnion arrangement so designed that in a single movement the sand and water for the mix are deposited in the mixer hopper. The specified batch of stone or gravel is placed in the hopper by means of a batcher or other measuring device, and the cement is introduced into the batch in the customary manner. While this inundation method is revolutionary in character, its arrangements are exceedingly simple

and its installation does not necessitate any material change in the contractor's general plant or any interference with his system of work.

How the Inundator Supplies the Correct Amount of Water

When it is remembered that a very slight variation in the amount of water in concrete has a decided influence on the strength, it will be apparent that constant results cannot be obtained without finding a method of correcting not only the bulking of the sand, but also the water carried by the sand. Thus, it is clearly shown that, in addition to compensating for the moisture or lack of moisture in sand, the further demands of constant concrete are that an equal and exactly measured amount of water be placed in each batch.

In the description of the Blaw-Knox inundation method above, it was stated that an excess-water



BLAW-KNOX INUNDATOR USED BY THE TURNER CONSTRUCTION COMPANY ON THE PITTSBURGH STADIUM, PITTSBURGH, PA.

measuring tank for the purpose of storing additional water for the batch is incorporated in the inundator. This functions as follows: The exact amount of water necessary to inundate a specified amount of sand is a known quantity; that is, the amount necessary to fill the voids in the measured sand, which is insufficient for the batch itself. The excess-water tank is therefore used to measure for each batch sufficient additional water to complete the batch. Thus, we have the two variable elements adjusted: (1) an exact measure of the sand; (2) exactly the right quantity of water; both as specified by the engineer for the manufacture of the best possible concrete for the particular job.

Value of the Inundation Method to the Engineer and to the Contractor

In specifying the inundation method, the engineer automatically makes sure that the carefully worked-out formulas he has determined as being the best for the structure under consideration will be absolutely followed; that all possible chances for variation in the concrete due to the bulking action of sand and measurement of water, which have hitherto been uncontrollable factors, will no longer exist; that he is imposing no hardship on the contractor, because the addition of the inundation method to the contractor's equipment is small and permanent, and represents a direct economy.

The inundation method in relation to the con-

tractor means that he has a permanent addition to his plant which enables him to produce absolutely consistent, uniform concrete automatically without additional labor. It provides a means for batching and delivering fine aggregate and water to the mixer hopper as rapidly as by other existing methods. It gives an assurance that specifications are being absolutely adhered to and supported by adequate and convincing proof. It gives assurance that the estimated quantity of cement to make the estimated amount of concrete will check at the end of the job as surely as on the estimate sheet.

The Blaw-Knox inundation method is furnished for operation with a Blaw-Knox Batchplant or for separate installation in connection with the contractor's present equipment.

Making Cast Iron Pipe

By Frank Grossmann

U. S. Cast Iron Pipe & Foundry Co.

THE first cast iron pipe of which we have any record is still in service after more than 250 years. This early pipe was cast horizontally and, as a result, it had to be made in short lengths. In spite of the fact that these pipe were only 3 or 4 feet long, much trouble was experienced in floating cores, resulting in defective pipe having thin walls on one side which often failed after a few years of service. With the relatively long horizontal area to be supplied with molten iron, it is not surprising that much of this early pipe showed soft spots and sand holes.

With the introduction of the vertical method of casting pipe, almost three-quarters of a century ago, these troubles were eliminated, and this improvement in manufacturing methods was followed almost immediately by the development of longer lengths of pipe. Cast iron pipe is now supplied in standard 12-foot lengths, although in the smaller sizes it is available in 16-foot or 5-meter (16-foot 4 $\frac{3}{4}$ -inch) lengths.

A trip through an old pipe foundry would be a revelation to most pipe users. There they would see the impression of a pipe made in sand, and after this is dried, the introduction of the molten iron, which later cools in the form of pipe. It is a complicated process carried on in an atmosphere of dust and smoke that handicaps the workmen and makes the uniformity of the product the more remarkable.

Sand Casting

The pipe are cast in round iron flasks considerably larger than the pipe to be made. Into this flask is lowered a metal pattern, and the space between the flask and the pattern is filled with especially prepared sand. After this sand is packed tightly in place, the patterns are withdrawn, leaving in the sand an impression the shape of the outside of the pipe. This is known as the mold, and after it has been coated with blacking, to give a smooth surface to the iron, it is dried by placing it in an oven over night.

At the same time, the core for forming the interior of the pipe is being made. The metal bar

on which the core is built up is first wound with a combustible rope of hay. Later, as the pipe is poured, this rope burns, permitting the bar to be withdrawn. Outside the hay are placed successive layers of loam, which build up the bar until it is the required size to form the inside of the pipe. The calking space on the inside of the bell is formed by the separate core which fits over the main core. Both of these are coated with blacking before being dried.

The cores are lowered in place in the center of the mold, and the space between the mold itself and the core is filled with molten iron, forming the pipe. When the iron has set, the flask is opened and the pipe rolls out into the cleaning shed. After the pipe has been carefully cleaned, it is again heated and dipped in the tar and oil coating.

The only real improvement in this method of manufacturing pipe has been the recent introduction of pipe cast bell end down. Prior to the introduction of this change the bells were formed at the upper end of the flask, and this occasionally resulted in the entrapping of impurities in the bell itself. By placing the bell at the lower end of the mold, it is possible to cast a large "riser" on the spigot end, which may be machined off, eliminating any possibility of impurities remaining in the pipe.

Centrifugally Cast Iron Pipe

The introduction of deLavaud centrifugally cast cast iron pipe, some three years ago, resulted in an immeasurably better pipe at a less cost, and seems to be destined to alter the whole pipe-making industry. We are accustomed to speak of the centrifugal method of casting pipe as a new development. Actually, this is not the case, as the first patents governing the casting of metals by centrifugal force were taken out over a hundred years ago, in 1800. Early foundrymen were handicapped by their efforts to use sand molds in the centrifugal machines. These molds were not strong enough to withstand the force of the molten iron when they were rotated. It was not until permanent molds were perfected by D. S.

deLavaud that real progress was made.

The deLavaud machine for casting pipe by centrifugal force consists of four essential features—the mold, the mold casing, the spout, and the pouring basin. The permanent steel mold, just the shape of the outside of the pipe, is rotated in a slightly inclined position. This mold is enclosed in a casing, and between the mold and the casing passes the cooling water. In addition to the rotation of the mold, the mold and casing have a horizontal travel equal to the length of a pipe, so that at the start of pouring, the mold may be advanced to completely cover the cantilever spout which carries the iron. This spout is supplied with iron at a uniform rate of speed from the pouring basin at the upper end of the machine. Iron is introduced into the rotating mold and is thrown by centrifugal force to the inner surface. At the same time the mold retreats, so that the pipe is built up throughout its length.

The cool mold causes the metal to set almost immediately, and after a few seconds the pipe may be withdrawn. Still retaining a great deal of the heat of the molten iron, the pipe is carried to an annealing furnace, where any possible chill of casting strain is removed.

With this improvement in the method of manufacturing, it is only natural to expect an improvement in the product. Perhaps the greatest change is in the tensile strength of the iron. Specifications governing the manufacture of cast iron pipe require a strength of 18,000 pounds per square inch, while deLavaud iron develops a strength of from 36,000 to 42,000 pounds per square inch. Actual bursting tests on pipe show even more remarkable results. Standard 6-inch sand-cast pipe will usually fail at about 1,300 pounds per square inch internal pressure. The equivalent deLavaud pipe, although a third lighter in section, will withstand 3,000 pounds per square inch.

The absolute uniformity in section of deLavaud

pipe, together with the increased tensile strength, permits of a reduction in thickness, and this results in a larger bore for the pipe. With the absolutely smooth interior found on this material, the carrying capacity is greatly increased. The light weight of the pipe results in ease of handling in the field, and the adoption of a bell-and-spigot joint similar to that used by the Metropolitan Water District of London, which is practically self-centering, causes a further reduction of installation costs.

Plain-End Pipe

Perhaps the most recent development in the art of jointing cast iron pipe is the use of plain-end pipe with bronze welded joints. For this type of installation deLavaud pipe is ideal, as the density of the iron eliminates the necessity for pre-heating. In this type of installation, a collar of Tobin bronze is built up with an oxyacetylene torch over the ends of two plain-end pipe which have been butted together. As the tensile strength of the bronze is 50,000 pounds per square inch, a joint of this kind is practically as strong as the pipe itself. A recent installation of 20,000 feet of 6-inch deLavaud pipe with this type of joint shows that it is easy and economical to lay and that it forms an absolutely tight line under high pressure.

It is interesting to note that although we have improved the method of manufacture and the type of joint for cast iron pipe, the metal remains typically cast iron. For centuries this material has been the standard for water installations, and, with the improvements in the method of casting, it is probable that cast iron will be the standard for years to come.

ACKNOWLEDGMENT.—A paper read before the Tenth International Purchasing Agents' Convention, at Milwaukee, Wis.

Shaft Method of Excavation on Philadelphia Subways

THE Keystone State Construction Company, which has been awarded two subway contracts in Philadelphia, totaling approximately \$30,000,000, is using the shaft method of construction. On one contract there were three sewer crossings and a bridge and railway crossing to be reconstructed or underpinned. For the line and station construction the method of procedure was trench excavation under cover. The contractor opened and held a trench 65 to 70 feet wide and 25 to 40 feet deep, the full street width, covered it from curb to curb and carried on the underground work by shafts. Removal of the asphalt on concrete pavement and excavation to the depth necessary to put in the platform of planks, stringers and cross-beams, was carried on by half a dozen outfits of portable compressors, paving breakers, and clay diggers. With the roadway paved over, digging was begun at the shafts, and the platform was carried on posts as the excavation was opened up. The timbering was further carried down in about 5-foot lifts as the trench was deepened. There is no light timber in the whole frame, even 3 x 10-inch plank being used for the diagonal sway-braces.

The spoil track is 24-inch gage with 20-pound rails and metal ties. On it the spoil is taken to the shafts by 2-ton locomotives and flat cars carry-

ing 36-cubic-foot buckets. At the shaft the bucket is lifted by a derrick and dumped into a head-frame hopper. From there the spoil goes to trucks which run to a railway siding and dump into cars. There were 15 of these spaced 450 to 815 feet apart, depending on the depth and width of the cut, to give approximately the same amount of excavation per shaft.

With a full-width trench and excavation in progress along nearly two miles, the encumbrance of the street surface and the hindrance to traffic are negligible.

The central mixing plant serving this contract is equipped with two 28-S Smith non-tilting concrete mixers, electrically driven, with batch hoppers. Blaw-Knox overhead steel bins equipped with batchers serve the mixers. These bins are served by two bucket elevators, one for sand and one for stone. The sand and stone are delivered to the job by trucks, dumped into these bucket elevators, and then transferred to the bins. The mixed concrete is distributed over the job by a fleet of 1-ton trucks with automatic dump bodies.

Keystone State has recently placed an order for another 28-S Smith non-tilting mixer electrically driven, a duplicate of the first one for installation in the second central mixing for the second contract.

Who Pays for "Free" Service on Cement Sacks?

An Interesting Study to Which the Contractor Should Give Thought

SINCE the world began, man has always been on the outlook for something for nothing. It has been human nature, since Adam and Eve tried to get knowledge by eating the apple in the Garden of Eden, for everyone to strive to obtain some advantageous thing free of charge, but the "gifts" in business of free service, free packages, free delivery, so desired, are not so generous as they seem. There may not be, so far as the customer is concerned, any visible charge for these items. In fact, a service often brings in enough business to more than pay for itself and does not raise the price of the commodity, yet the cost of rendering service is a part of the cost of doing business and must enter into it just as wages, rent, and other items do. In this way service does cost money.

In business there is a constant cry for more and more special service. Customers expect a concern to perform this service, and good business concerns do so. In some instances no visible or separate charges are made the customer for this, while in others the charges are clearly itemized.

The Non-Returnable Package

When you get a bottle of pickles at the grocery store, you don't get the bottle free. The price you pay is not only for the pickles, but also includes the charge for the bottle. It is not a separate item. It is not so much for the pickles and so much for the bottle, but the pickle man certainly charges you for the container, nor does he give you a refund for returning it. The reason is that its value is not as great as the cost of the work involved by the retailer, jobber, and maker in paying for, collecting, storing, and cleaning the empty bottles. The same is true in the case of a can of tomatoes, a sack of flour, a box of candy, or a barrel of apples. Part of the price you pay is for the container.

The same is true in the case of paper cement bags, according to the officials of the Universal Portland Cement Company, Chicago, Ill. The price you pay for cement includes the charge for the package, and as the package is not usable again, there is no refund if you return it.

The Returnable Package

In general, the same also is true for the cloth cement sack, but with this exception. The package is more readily and economically usable again than is the pickle bottle, tomato can, flour sack, candy box, apple barrel, or paper cement bag. In fact, the cloth cement bag is so economical a package for the cement user that he specifies it for about 90 out of 100 sacks of cement shipped.

In the case of any package or any commodity, the user of the commodity pays for the container, be it carton, sack, tin, bag, barrel, bottle, or box. If it is a paper cement bag, he pays the entire cost at once and there is no refund for the return package. If it is a cloth cement sack, he pays only for a part of the total package cost. He pays for those sacks that are lost, diverted to other uses, or made unfit for further use because of damage by water or other agencies, torn beyond repair through misuse, or worn out. When he returns the others to the seller, the full charge originally made is re-

funded to him. Thus it is that the cloth cement sack comes nearer being a free package than any other container.

The economy plus the convenience of the cloth cement sack is what makes the user prefer it so strongly over other methods of shipment, but the cloth sacks, like other containers, cost money, and this cost goes into the cement maker's manufacturing or operating costs. Every business organization, to continue its existence, must require its customers to pay its entire manufacturing, operating, and other expenses. That is the only basis on which a concern can remain in business.

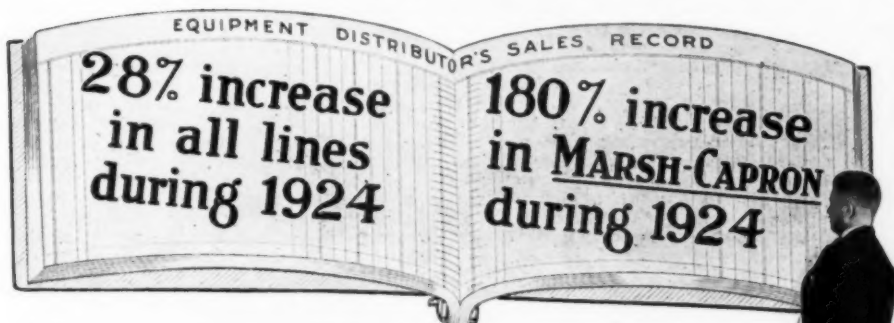
Cloth Sacks versus Paper Sacks

Comparative figures show that if the user takes his cement in cloth sacks which are returnable, his package cost on the average is about one-third as great as if he takes it in paper bags which are not returnable. Through proper care of cloth sacks the user can keep his package cost decidedly below this average. That means that the cloth sack is providing the service of keeping his cement cost down.

On the other hand, the packing of cement in paper bags is advantageous to the cement maker. He has none of the detail work and expense such as is incurred in the handling of returned cloth sacks. His only investment is represented by an



TYPICAL SCENE IN SACK STORAGE WAREHOUSE OF CEMENT MILL, SHOWING THOUSANDS OF CLOTH SACKS IN RESERVE TO INSURE UNINTER-
RUPTED SHIPMENTS



When this Distributor talks, Contractors sit up and listen

This "equipment man" has contractor customers who go miles out of their way to do business with him.

He has a good-sized outfit, and has built up a big reputation for knowing what's what, and for looking after the interests of his customers. They rely on what he says.

Right from the start it has always been his policy to make money by saving money for the contractor—he is "on his toes" to get hold of a line that offers his trade the best possible value.

And each year his business has shown a healthy growth—his total sales for 1924 climbed 28 per cent above 1923.

Built better—but built so economically that they're sold at a reasonable price.

Here are 6 points that make a strong appeal to the successful contractor—that have played an important part in the increase in MARSH-CAPRON sales:

- (1) Better value—and better built, regardless of price.
- (2) These mixers give—lower cost concrete, saving time at every step in the mixing cycle.
- (3) Built stronger all the way through—bigger channels make a stiffer main frame; rail tracks protect the drum, etc., etc.
- (4) The only mixers ever built to carry a definite guarantee covering the trade-in value—also a guarantee protecting the user on rebuilding cost.
- (5) Prompt and efficient service on repair parts—with low prices for parts.
- (6) A complete line—includes 3½-T and 5-T tilting mixers, and "rail-track" mixers in sizes 3½-S, 5-S, 7-S, 14-S, 21-S and 26-S. Also the Marsh-Capron "Universal" Mortar and Plaster batch mixer.

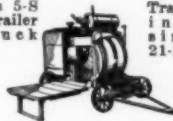


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Among this distributor's group of hand-picked "value lines" of equipment, MARSH-CAPRON Mixers had the biggest sales increase in 1924—and we are frankly proud of it. His MARSH-CAPRON Mixer sales showed 180 per cent increase, as compared with the 28 per cent increase that he averaged for his entire business.

So far during 1925, his MARSH-CAPRON Mixer sales have been going even better—a month ago they ran 38 per cent of his total business, in spite of the fact that "MARSH-CAPRON" is only

one of the 15 good equipment lines that he carries.

And there are other MARSH-CAPRON distributors showing just as healthy an increase in their mixer sales.

Real Value is what sells contractors' plant

You can see why these distributors are making such increases, when you inspect a MARSH-CAPRON Mixer. Size up the extra years of service built into these mixers—it's easy to see the extra value they offer, as working tools for contractors who want to turn out lower-cost concrete.

The distributor who sells "MARSH-CAPRON" is giving the customer more for his money. That's why our production for 1924 ran 63 per cent ahead of 1923—and why this year's sales are going ahead the same way.

Marsh-Capron Company

11 So. LaSalle St. Chicago, Illa.

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inventory sufficient for current needs. The use of cloth sacks, however, requires an investment in buildings and equipment for receiving, cleaning, counting, inspecting, and repairing sacks returned by his customers and for tying and storing both old and new sacks. In addition, he has also the cost of labor for these operations and the expense of clerical work in keeping records and issuing credits. Then he must provide at all times a sack reserve sufficient to insure uninterrupted shipment of his product, which means that he must carry an investment in cloth sacks which at the beginning of the season is very large.

Service for the Buyer

In the face of this, surely no one can doubt that the cement maker or dealer, could he have his preference, would favor a non-returnable container. Why doesn't he, then? Simply because users generally prefer the returnable cloth sack; because they specify it for about 90 per cent of all the cement shipped; because it is good business for the seller to supply his product in the container his customers prefer.

In other words, the seller finds that the service thus given the user is worth the difficulties of performing it. In rendering this service specified and preferred by users, the seller must charge his various sack-handling costs to his overhead or operating costs. In like manner, the buyer should charge these items to his cost of handling cement.

Protects Careful Users

By charging for the package along with the cement and allowing credit for it on its return in good condition, the seller requires each user to replenish the supply of sacks only in proportion to his share in its depletion. If, through accident or otherwise, the user loses or destroys 10 sacks, he pays for 10 sacks. If he loses or destroys 1,000 sacks, he pays for that number. Thus a fair and equitable basis is established so that careful users do not pay for losses caused by careless users.

It is only when the buyers of cement pay for the sacks in proportion to their share in the depletion of the supply that this fair basis can be maintained. Some users of cement feel that full credit should be allowed on all sacks returned whether serviceable or useless; in other words, they favor the cloth sack as a free package. Were the cement maker to do this, it would result in negligence on the part of users in the care and return of sacks and, with the decrease in returns, there would be an increase in the cost of operation to the seller which would obviously bring an increase in the price of cement in proportion to the negligence. This would mean that the man who was careful in handling sacks would have to pay a higher price for cement caused by the careless user who neglected to return his sacks in good condition or to return them at all.

Cement users quite generally agree that they should pay for sacks damaged by water or other agencies while in their hands. Certain ones, however, feel that they should not pay for sacks worn out in service through natural wear and tear. All users help to wear out the sacks in which the cement they use is packed. Thus all users naturally should bear their share also of the expense of replacing sacks worn out in this way. In other words, the cost of replacing worn-out sacks is just as much a part of the cost of producing, selling, and shipping cement as the cost of replacing sacks that are irreparably damaged or not returned. In the end, the user must pay this package cost the same as he does for sacks he loses or misuses and fails to return. It is no different from what the user of any commodity does. If the cement maker or the retailer absorbed the cost, he would have to add it to the cost of the product, and in the long run the user would have to pay for it, anyhow. Furthermore, if it were done in this way, it would upset the entire equitable practice now pursued whereby each user pays directly only for the sacks which he receives and which are made

unserviceable for any reason while in his hands or are not returned.

What Makes Cloth Sacks Useless

Roughly, one out of every eight sacks shipped goes out of service for one reason or another. The principal reason is that the sacks are allowed to get wet. Other causes include the diversion of sacks to other uses, the rendering of sacks useless on account of misuse, and the natural wearing-out of sacks through continued service. Much of this loss can easily be prevented through better care of

sacks, and the cement user can thereby keep his package cost at a very low figure. On the average, about five times as many sacks never are returned as are found to be useless after return to the mill.

A sack cannot last forever. It will eventually wear out. And since the user must in the end pay the package cost, the fairest and what has proved to be the most equitable method is to charge the user directly for the sacks which have just merely worn out in his hands, as well as for all sacks made useless while in his hands and sacks which he fails to return.

On this basis, the retailer in cement should not absorb any sack loss unless sacks are lost, destroyed, or diverted to other uses while in his own hands. Any sacks returned to him in unserviceable condition should not be credited to his own customers, just as the manufacturer does not credit useless sacks to his customers. At times the argument is advanced that the retailer must allow full credit for returned sacks, regardless of condition, on order to hold his accounts. While this is not sound practice, the retailer should, if he follows



REPAIRING DAMAGED SACKS TO PERMIT RE-USE

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Size for size—and weight for weight—the new Cletrac Model "K" (15-25 H.P.) is the greatest tractor value on the market today. For downright dependable performance under all conditions, this rugged, easily handled machine is a revelation. It pulls with ease an 8-foot grader *with full bite*, and its turning radius equals its own length.

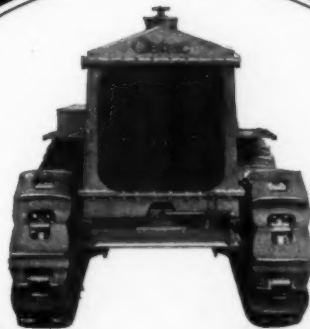
Exclusive CLETRAC Developments

Model "K" Cletrac is the only tractor with an instantaneous oiling system. A simple push of the hand plunger oils the lower track wheels perfectly. Crawler tracks are quickly adjusted by "take up" with a regulating screw, giving an absolutely uniform align-

ment, front and rear. All working motion is eliminated by seven closely assembled track wheels which also cause a maximum of track gripping the ground and a corresponding increase of draw bar pull. All parts easily accessible.

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such practice, charge the loss to his selling cost and not to the cement maker.

A Service for the User

The cement maker and the retailer furnishing cement in cloth sacks are performing a service to their customers. In charging them for the sacks lost, destroyed, or returned in useless condition, they are merely carrying out a sound business practice such as the users themselves would do if they were sellers. The sellers inconvenience themselves in furnishing cement in cloth sacks and are willing to do this because the returnable cloth sack is more economical for the user than any other form of package yet devised, and because the user prefers this in spite of whatever inconvenience it may cause. It is just another case where the advantages outweigh the disadvantages. In the practice as here outlined, cement maker and dealer charge the user only in proportion to the number of sacks which he loses or renders useless, and thus enable the user to obtain cement at a lower cost.

The cloth sack used in shipping cement is not a free package. It costs money. Someone must

pay for it. It would not be fair to the careful to require them to pay for the carelessness of others. The practice of charging for sacks lost, destroyed, or returned in useless condition is most advantageous to the buyer in every way. While this means additional work for the cement maker and the dealer, it provides the basis for what the user himself prefers. It keeps the cost of cement down for him and therefore keeps the cost down on all construction in which cement is used.

Just as the pickle bottle, the tomato can, flour sack, candy box, apple barrel, and paper cement bag are paid for by the user, so must the cloth cement sack be paid for by the user. There is no such thing as a free package. A near approach to it, however, is the returnable cloth sack. Considering the service it performs and the value of the product, it costs the user proportionately less, perhaps, than any other container for any commodity. The reason for this is that, unlike most containers, it is returnable, which thus enables it to make many round-trips during its life and so keep down the cost of an important building material that enters into almost every form of construction.

Protecting Aransas Pass, Texas, from the Sea

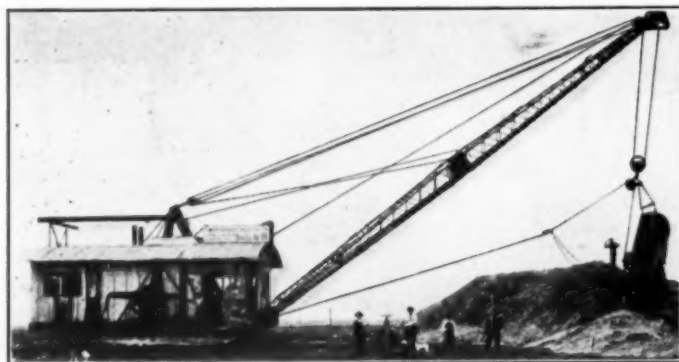
By George F. Paul

TO protect Aransas Pass, on the seacoast of Texas, from the terrific storms that at certain seasons of the year sweep with destructive violence across the Gulf of Mexico, extensive levees have been built. The Gulf storm of August, 1919, practically destroyed the town, but the people voted bonds to build the protection they now have against storm tides. The form of protection decided upon was earth embankment, of which there is now two miles paralleling the bay shore in front of the town, with a wing levee on each end running in-shore to high ground.

The west wing levee is 6,200 feet long, and the east levee is 1,200 feet. Specifications on the west wing levee called for a 10-foot crown, a 70-foot base, side slopes of 2 to 1, and an average height of 15 feet. The front levee has a 40-foot crown, a 100-foot base, a 2 to 1 slope, and an average

height of 15 feet. The east levee has a 10-foot crown, a 70-foot base, and 2 to 1 slope, and is 15 feet high.

The equipment used by the Howard Kenyon Dredging Company, Houston, Texas, contractors for the job, included a 3-cubic-yard 70-foot boom Monighan walking dragline. The total number of cubic yards of material handled on this project was approximately 900,000. The work was completed in exactly one year. The total cost of the project was about \$125,000. The material used in building the levees was excavated from the bay side of the embankment, leaving a 25-foot berm and a borrow ditch with a 3 to 1 slope. The borrow ditch is now connected up with the waters of the bay and will serve as a safe place for pleasure and fishing boats.



MONIGHAN
DRAGLINE BUILDING
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WHAT brings new people to the smaller towns? *Good roads!* What takes to market the goods they manufacture and the crops they grow? *Good roads!*

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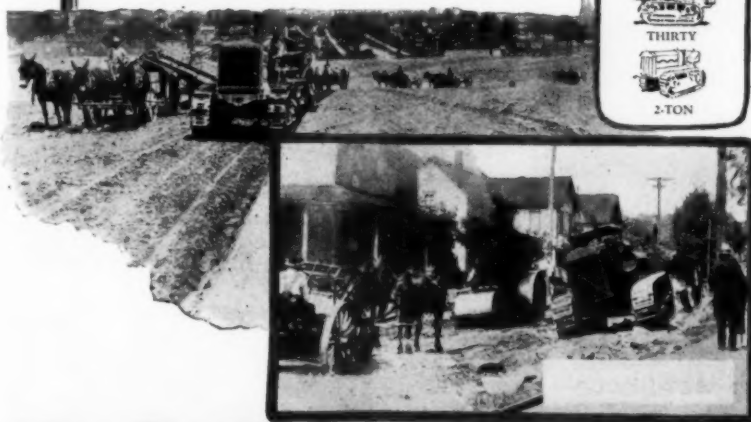
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Make Night Work Pay

Proper Illumination Makes Bigger Profits

AT this season of the year, when days grow shorter and owners are anxious for completion of work, the night shift becomes a very important factor in the success or failure of a job. By taking advantage of the night shift, progressive contractors are securing work against their competitors, in view of records of completion. They are also getting greater profits by utilizing

expensive plants throughout two or more shifts per day.

In order to get the best results from night work, by eliminating delays to men and machines, it is essential that the work be well lighted. The standard light that is now used all over the country and is giving good service is the portable acetylene flare light. The accompanying illustra-



TYPICAL USES OF
ACETYLENE FLOODLIGHTS ON
CONSTRUCTION WORK



Contractors **LABORERS X TIME = DOLLARS** **BATES WIRE** **BAR TIES**



Tying Concrete Reinforcing Bars with Wire Tie
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ASK YOUR DEALER

Will save you time, labor and dollars.
No skilled labor required to use this equipment.

Two or three turns with tying tool and bars are tied.

Ideal to use in cold weather—men do not have to take off their gloves.

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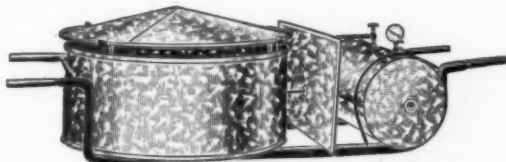
BATES VALVE BAG CO.

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HEAT—for Winter Construction

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Reynolds Portable Furnace—Construction Type 2



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Ideal equipment for zero winter construction. The Reynolds Portable Furnace equals four to ten salamanders. No coke gases—no smoky or sooty walls—no lugging fuel.

"It is our belief you have a furnace which will eventually supplant salamanders on building construction," writes one big user.

A marvel of simplicity in operation and construction. Write for details.

Distributors wanted for a few territories which are still open.

Reynolds Portable Furnace Co., Inc.

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Contractors write us for names of dealers in your territory

REYNOLDS PORTABLE FURNACE

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tion shows one of the Milburn acetylene lights, made by the Alexander Milburn Company, 1416-28 West Baltimore Street, Baltimore, Md. This is an 8,000-c. p. portable light, which is 6 feet high, weighs 60 lbs., and is equipped with handles so that it may be carried from place to place without difficulty. It will burn for 12 hours on 8 lbs. of carbide at a cost of $3\frac{1}{2}$ c per hour, continuously or intermittently. The flexibility of these lights allows the rays to be thrown in any desired direction, either horizontal or vertical.

When commercial carbide and water are combined, a gas called acetylene is generated. Carbide comes in several sizes and forms. The form most generally used is ordinary commercial carbide in lumps $2\frac{1}{4}$ inches x $\frac{1}{2}$ -inch in size, as this size yields the greatest number of cubic feet of gas per pound and is obtainable everywhere. The charging and lighting are easily performed by unskilled labor.

The carbide is placed in a carbide holder containing a series of conical-shaped pockets. This holder fits into a gas bell slightly larger than the holder, there being only enough space between the two to form a gas chamber. These in turn are placed in a square tank which forms the base of the light, and the tank is then filled with water. The water acts on the carbide, immediately generating a gas in the chamber, which rises through an inverted "U" pipe, travels down through a gas washer in the base and thence up through the feed pipe to the burner. This process assures a thorough cleansing of the gas and results in a bright, clean light.

The sludge, or slaked carbide, is easily removed from the conical pockets by taking out the carbide holder and dumping it. The water in the tank need not be changed. The standpipe, burner and reflector are not handled.

The brilliancy of the light is assured by the relatively large water-supply in the square tank. The water column automatically maintains a steady flow of gas at the burner without any attention whatever. As the internal pressure within the lights can never exceed the water column, a large factor of safety is assured. When the light is turned off, the increased pressure of the gas automatically forces the water from the carbide

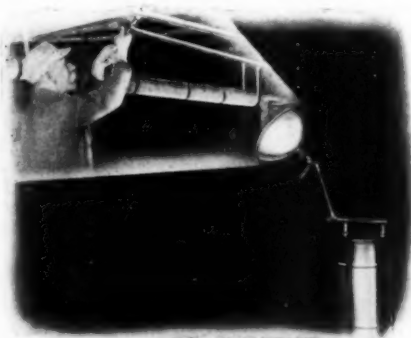


A MILBURN
8,000-C.P.
ACETYLENE
FLOODLIGHT

chamber, thus preventing any generation while the light is out. This not only insures safety, but keeps the light ready for use at all times. When fully charged, these lights will burn from ten to twelve hours with practically no care.

A recent ruling of a state department of highways reads: "If the cement has been dumped upon moist aggregates for a period of two hours, the batch shall be rejected." Such rulings and other obstacles are always cropping up and necessitate the contractor's always being on the job to overcome them. Besides the utilization of a carbide light to avoid unnecessary wastage in such cases, the lights may be applied to tunnel work, in concrete-lining tunnels, for drill runners, in excavation, for steam rock drills to loosen up material for scrapers next day, on revolving shovels, and in grading, pile driving, installing machinery, and easily than in daylight conditions.

The safety of these lights is assured. The operation is simple and fool-proof. Milburn lights are listed as standard by the National Board of Fire Underwriters, and are in use by many of the largest contractors and industrials in the country.



PORTABLE ACETYLENE LIGHT USED TO FACILITATE INTERIOR REPAIRS



GRADING OPERATIONS ON CLEVELAND'S NEW AIR FIELD, WHICH IS OVER ONE MILE SQUARE. This field was cleared and graded by Frank Smith, using 16 Fordson tractors with Schaefer one-man scrapers



Hauck Concrete Heater on One Bag Mixer

Concrete Mix raised to 65° F by Hauck Concrete Heater

"Before Hauck Heaters were adopted, the sand and gravel were heated by means of wood fires. Scrap wood around the job was used for fuel. This method involved handling and rehandling of the materials and was very inconvenient. Three men were needed for this work for a one-half cubic yard mixer in the cold weather. This labor is eliminated by the use of the Hauck heaters. The labor saving amounts to \$15.00 per day."

(Copied from Nielson Survey No. 25)

Why Hauck Concrete Heaters repay cost in 11 days is told in report by A. C. Nielson Co., Chicago, Ill.

Send for your copy and bulletin No. 1002 on the two sizes of heaters.

HAUCK MANUFACTURING CO. 149 TENTH ST. BROOKLYN, N.Y.

What It Stands For

Over sixty years of experience in designing and building high-grade boilers.

A modern plant, specially equipped.

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Record Digging for New Power-Plant

Excavation for \$30,000,000 Power-Plant at Avon Beach, Ohio

THE Cleveland Electric Illuminating Company is now excavating for a mammoth power-plant on the shore of Lake Erie at Avon Beach, Ohio, between Cleveland and Lorain. It is estimated that the total cost of this plant will be \$30,000,000 when completed. The Hunkin-Conkey Construction Company, of Cleveland, Ohio, the contractors on the job, tackled a real digging job, as the formation from the surface

were so large that a single slab made almost a truckload. They were lifted into the truck by encircling them with chains and hooking the dipper teeth into the chains to lift the slabs into the trucks.

A huge hole, 27 feet deep, which looks more like a quarry than a building excavation, is about completed. They are now sinking the trenches about 18 feet deep below the bottom of the main

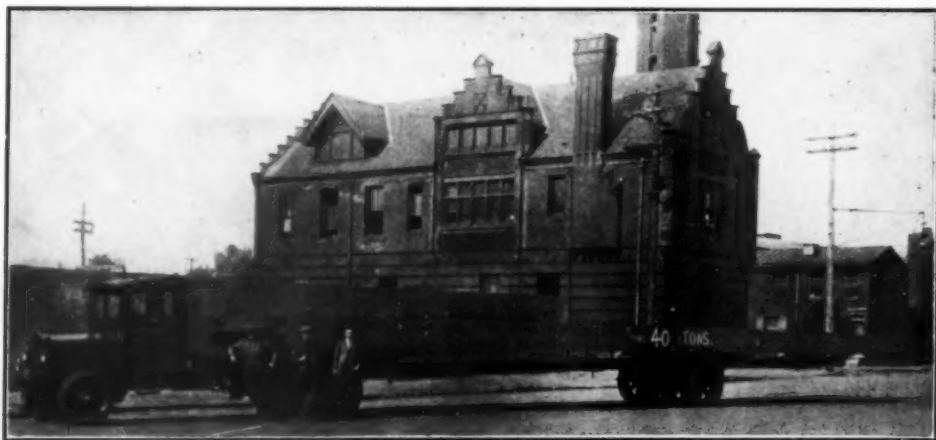


A FEW OF
THE SHOVELS
AT WORK ON
THE EXCAVATION
FOR THE
CLEVELAND
ELECTRIC
ILLUMINATING
COMPANY'S
NEW
POWER-PLANT

down is practically all hard blue shale.

So far, their performance on this job has been remarkable. They have handled 70,000 cubic yards of shale with three Thew steam shovels in about 40 days, or an average of about 580 yards per shovel per day. Many of the shale slabs

excavation. There will be almost 500 linear feet of these trenches about 15 feet wide. The standard 18-foot dipper stick with which one of the shovels was originally equipped was removed and in its place was put a 32-foot stick for cleaning the rock out of the trenches after it is shot loose.



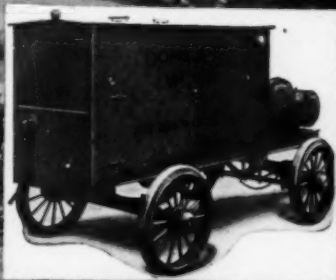
GARFORD TRUCK AND TRAILER HANDLING 40-TON GIRDER FOR DELAWARE RIVER BRIDGE BETWEEN PHILADELPHIA AND CAMDEN

Superpower

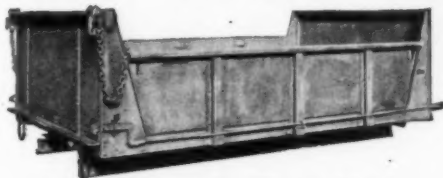
That's what you get from a "Domestic" Portable Air Compressor. The outfit illustrated is the 184 cu. ft. displacement size, and is mounted on rubber-tired trailer.

Write us for bulletin number 25 AC describing Domestic Air Compressor Outfits.

Domestic Engine & Pump Company
Manufacturers
Shippensburg, Pa.



Let WOOD Build Your Bodies



Specification Type H-1

Square corners, Removable sides that fit in stake pockets. Manually controlled double acting tail gate equipped with chains and pins. Material No. 8 gauge steel. All joints hot riveted. Front and rear are made higher to allow use of extension sides to give greater capacity.



We shall be glad to help you solve your problems.

Wood Hydraulic Hoist & Body Company

World's Largest Makers of Hydraulic Hoists and Steel Dump Bodies

7938 Riopelle Street

Detroit, Michigan

The very fact that many times "Wood Steel Bodies or equivalent" is specified by municipal, county and state departments when asking for bids, is evidence that these bodies are recognized as the standard by which others are judged.

Wood Steel Bodies are designed to fit a particular job and are sturdily constructed to give years of dependable service. The name "Wood" is your assurance of complete satisfaction.

When writing to advertisers, please mention the Contractors' & Engineers' Monthly—Thank you.

The Savings Effectuated by Adjustable Shores

Simple Device Proves Economical on Practically All Shoring Jobs

ADJUSTABLE shores are not a new idea. The savings and advantages of adjustable shoring have been common knowledge among contractors for ten years. In purchasing an adjustable shore, the contractor must make sure that they are 100 per cent automatic and fool-proof and so made that the act of setting and adjusting locks them securely. Atlas shores made by the Roos-Meyer-Hecht Company, 2824 Stanton Avenue, Cincinnati, Ohio, are made of two pieces of 2x4-inch stock 8 feet long with an extra-long 21-inch head. These 2x4-inch side pieces are held rigidly in position by five sheet-steel cross-ties securely toe-nailed to the side members. There are no projections, and the wooden pieces present a clean surface to nail to. Through the cross-ties a 1 1/4-inch concrete-filled pipe 8 feet long slides readily.

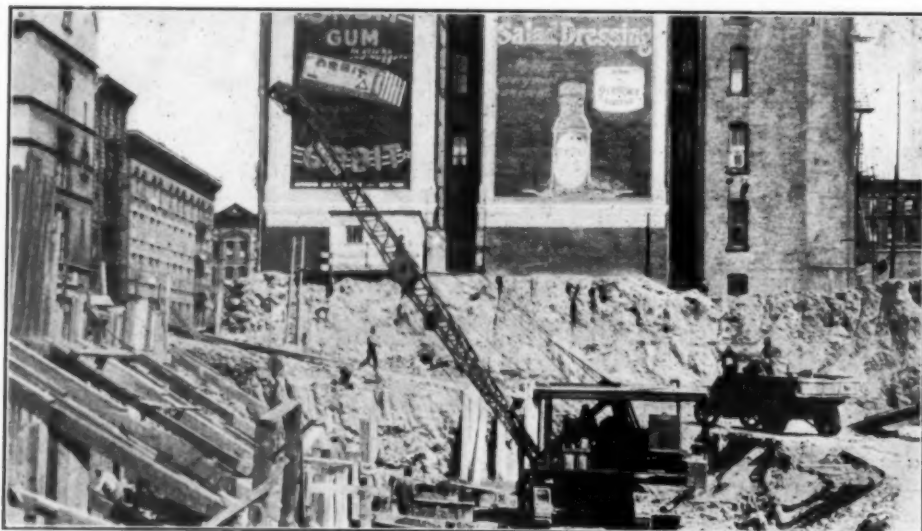
The locking device will grip in the usual position, or upside down, and the act of setting and adjusting locks it securely. The manufacturers claim that 95 per cent of shoring operations can be taken care of with these shores, as they have a 6 1/2-foot adjustment from 8 to 14 1/2 feet.

The shore locks itself automatically in any position on the upward movement of setting it in place, leaving both hands of the laborer free to handle the shore. To unlock the shore it is only neces-

sary to tap the locking plate downward, which releases the shore from the load. Then, holding the locking plate down with one hand, the shore is telescoped. Among the particular advantages claimed for these shores by the manufacturers, is that they save time, as 4 men can set more shores with these than 12 carpenters with 4x4 shores. On the average, workmen can adjust Atlas shores in place in 1 1/2 minutes each.

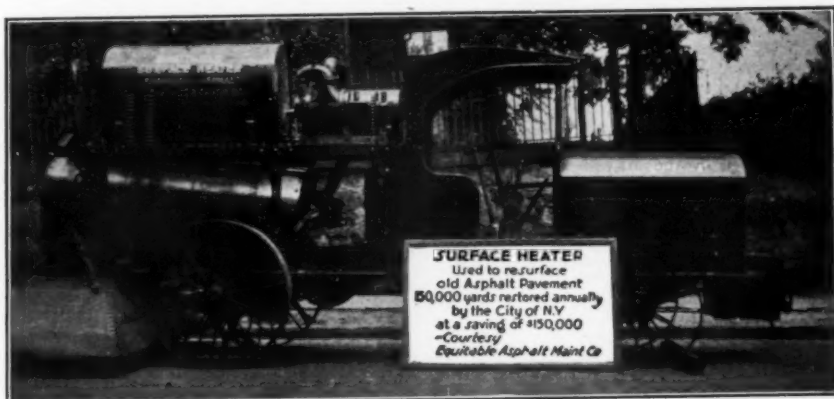
In a test at the engineering laboratories of the University of Pennsylvania and the University of Cincinnati, an Atlas shore designed for a working load of 3,500 pounds tested to 10,000 pounds. These shores, which are self-contained and have no projecting or loose parts, weigh only 65 pounds. There are no wedges or blocks needed, and one shore replaces a 4x4, two wedges, head, and head braces.

The average 4x4 shore costs for material 75 cents to make ready to set the first time. It costs 30 to 50 cents more before it is ready for each additional setting. It will stand about five additional settings and splicings before it goes to the scrap pile. That means a total cost of at least \$2.25, or 45 cents per placement. The first cost of an Atlas shore is less than \$5 and it does not have to be remodeled for additional placements, but will stand from 50 to 75 settings, according to contractors who use them.



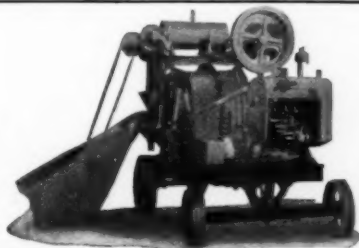
THE BEGINNING OF A NEW STRUCTURE FOR THE NEW YORK ACADEMY OF MEDICINE

Marc Eldlits & Sons, Inc., are the general contractors for this job at 103rd Street and Fifth Avenue, New York; York and Sawyer are the architects, and the Thomas Crimmins Contracting Company, 126 East 59th Street, New York City, has the contract for the excavation. The plot is 175 by 100 feet and the cellar is approximately 22 feet below the curb. The total excavation was approximately 5,600 yards of earth and 1,000 yards of rock. The excavation was removed by Erie steam shovel and Northwest crane. The foundation caissons were unwatered by a Novo double-acting diaphragm pump.

MAKE BETTER ASPHALT STREET REPAIRS**EQUITABLE SURFACE HEATER***(Improved Lutz Surface Heater)*

The new improved model is operated with a gasoline engine, designed for power at low speed. The change in this machine from steam to gasoline practically doubles its capacity, simplifies its operation, saves time and labor, permitting a more economical operation of the machine. It eliminates all dirt, water and steam and makes it possible to resurface without flame, from 1,500 to 2,000 square yards of pavement in an eight-hour day. It is easy to start and operate and anyone that can operate an automobile can easily run this machine.

A letter or post card will bring you full
and complete information as to terms.

EQUITABLE ASPHALT MAINTENANCE COMPANY**KANSAS CITY****MISSOURI****Atlas YARDAGE**

120 to 150 Cu. Yds. in 10 hours with an Atlas
one bag Mixer.

Atlas Mixers are of sturdy dependable construction, and the 7-S is regularly equipped with multiple cylinder LeRoi Engine, giving excess power.

We build 3½ ft., ½ bag, 1 bag and 2 bag Mixers.

Dealers write for agency proposition.

ATLAS ENGINEERING COMPANY**3036 GALENA STREET,****MILWAUKEE, WIS.**

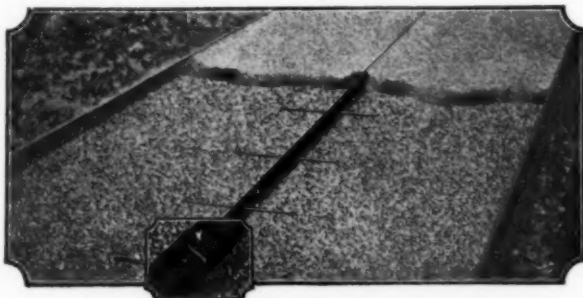
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A New Metal Contraction Road Strip

A Practical Method of Crack Prevention in Modern Concrete Road Construction

A STEEL contraction road strip or center joint for concrete highways, designed to meet the requirements of practically every state in which contraction joints are specified, is being manufactured by the Milwaukee Corrugating Company, Milwaukee, Wis. These Milcor contraction center joints offer a practical method of crack prevention. This construction detail has been officially adopted by the Highway Engineering Departments of the states of Illinois, Indiana, Kentucky, Michigan, Kansas, Missouri, Nebraska, Mississippi and Wisconsin.

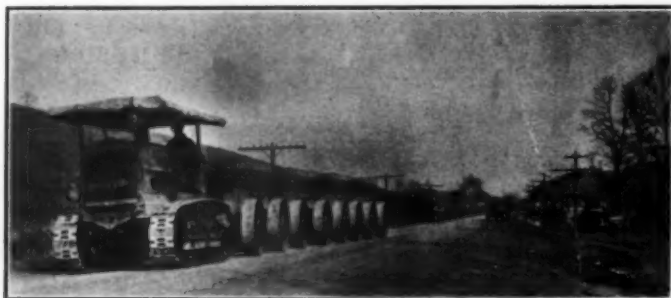
The Milcor road strip is easily installed. The sections overlap far enough so that the wedge pins hold both sections at their juncture and insure an absolutely tight, rigid joint. Additional holes for wedge pins are spaced 3 feet 4 inches center to center. The pins are driven through so that the top is about $\frac{1}{2}$ -inch below the top edge of the road strip. Holes for transverse



THE NEW MILWAUKEE CORRUGATED METAL ROAD STRIP

reinforcing bars are also provided at intervals of 5 feet. The standard length of the strip is 10 feet 2 inches. The standard heights are: $4\frac{1}{2}$, 5, $5\frac{1}{2}$, 6, $6\frac{1}{2}$, 7 and $7\frac{1}{2}$ inches, made from No. 16 or No. 18 gage steel, as specified. Special sizes, however, can be furnished to meet any specifications of city, county or state that contractors may encounter.

Road Work in Virginia



10-TON
CATERPILLAR
TRACTOR WITH
TROY TRAILER
OWNED BY W. W.
BOXLEY &
COMPANY,
CONTRACTORS,
ROANOKE, VA.

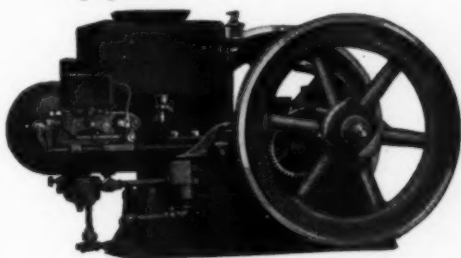
ONE OF
BOXLEY'S
JOBS DONE WITH
HIS 10-TON
CATERPILLAR
TRACTOR AND TROY
TRAILER TRAIN



LAUGH AND CHUCKLE

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When a gasoline engine built by Alamo Engine Co. is employed on your equipment.



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Most dependable.
Always goes.
Every engine makes good.
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A kid can start it.
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zation whose manufacturing and selling policy has been consistent and whose plant expansion and earnings have kept a conservative balance. In short:—To those with experience a sound investment and a MACK are one.

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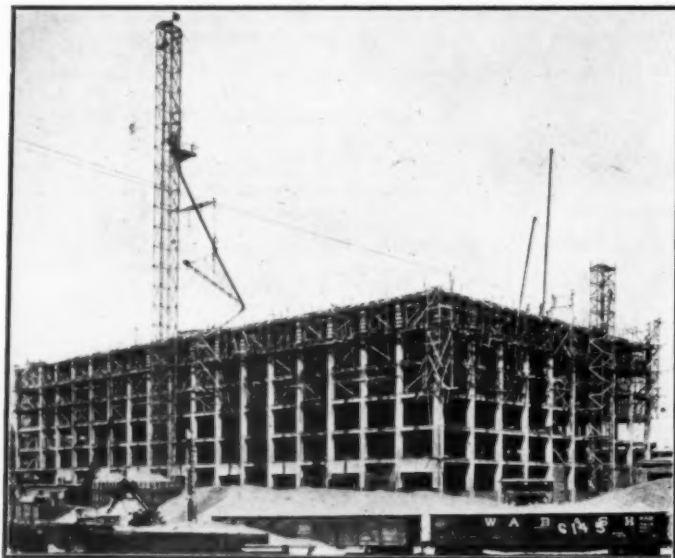
The Famous-Barr Relay Station Job, St. Louis

Seven-Story Reinforced Concrete Building Started in January and Roofed in July

IN the construction of the Famous-Barr Relay Station at Spring Avenue and Wabash tracks, St. Louis, Mo., the Boaz-Kiel Construction Company of that city showed remarkable organization and speed. The job consisted of seven reinforced concrete floors and a roof slab, in all of which there were approximately 10,000 cubic yards of concrete.

Excavation for the work began about January

consisting of one 216-foot Insley steel-tower counterweight quick-shift chuting plant, one 21-S Smith tilting concrete mixer, one $8\frac{1}{4}$ x 10-inch steam hoisting engine and two measuring hoppers for attaching to the bin which feeds the batch hopper on the mixer. The Geo. F. Smith Company also furnished the following new equipment which was purchased outright by the contractor: 800 Symons column clamps, 3,000 Uni-



THE BOAZ-KIEL
CONSTRUCTION
COMPANY'S
'FAMOUS-BARR
RELAY STATION'
JOB AT SPRING
AVENUE AND
WABASH TRACKS,
ST. LOUIS, MO.

15, 1925, and the pouring of the penthouses on top of the roof was completed July 1, 1925. The floor area is 45,000 square feet and when the Boaz-Kiel Construction Company started pouring the slabs they averaged a floor a week. Their daily output was 2,100 sacks in 7 hours.

On this job The Geo. F. Smith Company, Franklin and Channing Avenues, St. Louis, Mo., rented a complete concrete plant to the contractor

versal form clamps, Sterling wheelbarrows and concrete carts, a Clyde hoist attachment for a Fordson tractor, one 4-inch Domestic power-driven single-diaphragm pump and one portable gasoline saw.

In addition to renting the concrete plant, The Geo. F. Smith Company also rented two steam hoists to the Boaz-Kiel Construction Company, which were used for handling material.

New Method for Measuring Strains in Concrete Structures

SOME time ago the Bureau of Standards, Department of Commerce, brought out what is known as an "electric telemeter" for measuring changes in the length of structural members produced by variations in the load upon the structure. The operation of the telemeter depends upon the variations in resistance of a stack of carbon disks to the passage of an electric current. This is the same principle as that employed in the microphone in the transmitter of the telephone. There is, therefore, nothing new in the principle employed, but the Bureau was the first to apply this principle to a precision-measuring instrument.

Recently a new use has been found for this device in the measurement of the strains in mass

concrete. For this purpose a special cartridge has been designed which houses the stack of carbon disks and which is embedded in the concrete at the point where the measurement is to be made. Wire leads extend to the surface and are carried to some convenient point where the indicating instruments are placed. These instruments are calibrated to show any deformation in the concrete due to loading.

The instrument shortly will be used in an investigation which is being carried out by a special committee sponsored by the Engineering Foundation, on a dam to be erected at Fresno, Calif., which was described in the December, 1924, issue of CONTRACTORS' & ENGINEERS' MONTHLY.

KOEHRING

Gasoline Dragline



Faster Line Speed!

Don't forget it—faster line speed!

That means your Koehring will cast and retrieve the bucket more times each hour—every hour of the day—which means more profit on every job, season after season!

Faster line-speed is a money reason for you to prefer a Koehring! FINGER TIP CONTROL is another reason. The Koehring levers shift easily, not because of mechanical complications

that cause the operator to lose the "feel" of the load, but because the Koehring clutches function easily! You actually can shift Koehring levers with your finger tips! The operator never loses the "feel" of the load.

Koehring Heavy Duty Construction begins with design. The Koehring is not merely powered with a gas engine, but designed in every gear, bearing and detail for internal combustion engine power! Koehring Heavy Duty Construction is surest long service insurance!

Dragline Capacities

- No. 1— $\frac{3}{4}$ cu. yd. dragline bucket on 40 ft. or 45 ft. boom.
4 cylinder, 5 in. x 6 in. gasoline engine, 1000 R.P.M.
No. 2—1 cu. yd. dragline bucket on 40 ft. or 45 ft. boom.
4 cylinder 5 $\frac{1}{4}$ in. x 7 in. gasoline engine, 1000 R.P.M.



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Economy in Construction Through Electric Arc Welding

Welding by Eliminating Riveting Will Reduce Structural Steel Sizes Used in Construction

ACCORDING to J. F. Lincoln, Vice-President of the Lincoln Electric Company, Cleveland, Ohio, a superficial study of predictions for the future in the building industry and of the multiplicity of recent developments in this field seems to lead to the conclusion that the future course of construction will be chaotic. On the one hand there are the arguments of those who believe that the not far distant future will see buildings of 60 stories for commercial and office purposes, large centralized factories of multiple stories and great concentrated urban communities. On the other hand, the opposing views contend that the future tendency in building will be to comparatively modest commercial and office structures, factories of single floors and communities of limited size spread out over large areas.

No matter which of these conflicting views is correct, keen competition for business is sure to bring with it the demand for lessening the time involved in the construction of new or additional floor space, as the business world is finding that it can ill afford to have the regular course of its enterprise slowed down even for a short time. The builder who would keep pace with the changing order of things in the construction industry and get clear of the mass of conflicting claims will turn his attention primarily to developments which have been and are rapidly taking place in connection with the use, design and methods of joining structural steel.

Mr. Lincoln states that the basic changes in construction which are sure to come in the near future in practical building will center around electric arc welding of steel. Electric arc welding has already been applied successfully to a great host of construction purposes, and is daily showing itself more worthy of the place it is to occupy in the construction industry. The Lincoln Electric Company, Cleveland, Ohio, has produced direct-current welders now in use in practically all major industries involving the joining of iron or steel. There is a distinct advantage in the use of welded steel members, the joints of which have proved to be equal, if not superior, to riveted joints in strength. In a riveted joint allowance must be made in the structural part, which is of uniform cross-section throughout, for the material removed in punching rivet holes. Consequently, uniformly larger members are required for a given stress with riveted joints than when the joints are properly welded.

Scarcely a decade old, in so far as practical application is concerned, electric arc welding has swept away in part older practices in the major fields in which iron and steel are employed. The Lincoln Stable-Arc welder, by making it possible to secure a perfect weld, has now completely eliminated practically all of the objections which in early days might have been lodged against the general usage of the process. The variety of designs in which the Lincoln welder is put out makes it possible to use it in the shop or field at any necessary height or wherever steel is to be joined. Considering a tall building or a structure of wide



NEW AND OLD BUILDINGS OF PEOPLES OUTFITTING COMPANY JOINED BY WELDING
New portion is seen at right

spread, the saving effected by welded steel joints as against riveted joints may be readily understood, when it is remembered that the weight can be reduced probably by one-third through the use of the former method. In the case of such buildings, the difference between the 100-per-cent joint made by welding and that of from 50- to 75-per-cent efficiency secured by riveting, is of still greater importance, because the weight of the heavier parts which must be used in order to get the strength at the riveted joint becomes cumulative.

Through the one factor of a perfect joint, according to Mr. Lincoln, the "Stable-Arc" welding provides the answer to the bulk of economic questions which must determine the course of building engineers in the future. Obviously, the item of cost will be materially reduced through the welding because of the tremendous decrease in the weight of steel required for any given project. The factor of weight is cared for in like manner. Decreased weight and 100-per-cent joints in themselves through the welding process insure increased safety and strength. The reduction in the amount of steel required for a given welded structure provides more usable floor space for a given ground area.

The recently completed addition to the Peoples Outfitting Company's building in Detroit, Mich., is an illustration of the use of the Stable-Arc welder. All of the 103 girders joining the old building to the new 12-story addition were electric arc welded. The job resulted in the saving of several thousand dollars over the cost had riveting been used.

Panama Tilting Drum Trailer Mixer



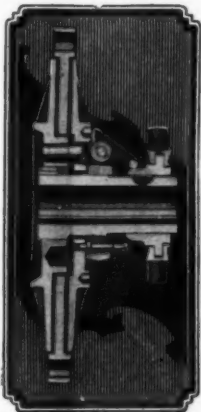
A handy 4 cubic foot mixer that can be easily transported from job to job. Substantially constructed to give maximum service.

The Panama Tilting Drum Trailer Mixer loads quickly and easily and will satisfactorily handle a large percentage of jobs on which larger mixers are now used.

Write for specifications, also catalog showing the complete line of Panama Quality Mixers and Concrete Block Machinery.

The J. B. Foote Fdy. Co.

32 Front Street
Fredericktown,
Ohio



A NOTABLE DEVELOPMENT

The efficient operation of modern heavy duty industrial machinery is due, in no small measure, to advantages resulting from the development of Twin Disc clutches:

Smooth, positive engagement of the load, without undue shock or strain to the engine or on the working parts of the machine.

Immediate and total release of power at the will of the operator.

Remarkably quick, easy means of clutch adjustment.

Minimum attention required.

Trouble-free clutch operation during the life of the machine.

Because of these advantages a majority of gas engine powered industrial machines are now regularly equipped with Twin Disc clutches.

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TWIN DISC CLUTCH COMPANY

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A Quarter-Circle-shaped Building in St. Louis

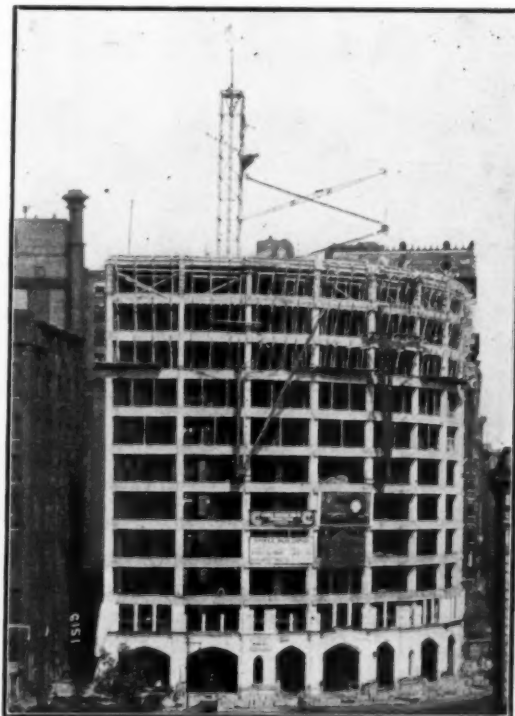
Data on the Roxana Petroleum Company's New Office Building

BUILDING operations on the Roxana Petroleum Company's office building at 13th and Locust Streets, St. Louis, Mo., were started by the Gamble Construction Company, general contractors, of St. Louis, on March 1, 1925, and the accompanying illustration was taken on June 15, 1925. The building is an odd-shaped affair, in that it faces on two streets and the building itself is the shape of a quarter of a circle. This odd construction makes the job somewhat unusual.

The Geo. F. Smith Company, Franklin and Channing Avenues, St. Louis, Mo., furnished the Gamble Construction Company with the following equipment: one Insley steel-tower quick-shift counterweight chuting plant, one 14-S Smith tilting concrete mixer with 4-cylinder Novo type AF gasoline engine, Symons column clamps, Sterling column clamps and Sterling wheelbarrows, and one 3½ Smith tilting concrete mixer for mixing brick mortar.

Road Show Program to Be Divided

BECAUSE of the large attendance at the National Convention of the American Road Builders' Association, President W. H. Connell has divided the program of the convention into two divisions, one especially attractive to engineers and highway officials, and the other prepared for contractors and machinery and materials manufacturers. Frank Sheets, State Highway Engineer of Illinois, and Treasurer of the American Association of State Highway Officials, is in charge of the program for the highway engineers and officials, and S. M. Williams, Vice-President, Autocar Sales & Service Company, is in charge of the contractors' program.



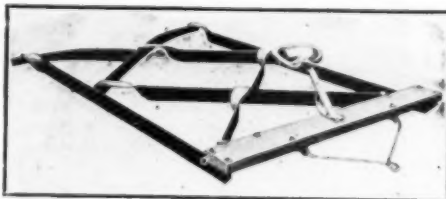
THE NEW ROXANA PETROLEUM COMPANY OFFICE BUILDING, 13TH AND LOCUST STREETS, ST. LOUIS, MO., FOR WHICH THE GAMBLE CONSTRUCTION COMPANY, ST. LOUIS, WERE THE BUILDERS

A New Steel Road-Drag

Crisscross Handling of Material from High Spots Makes Effective Machine

A STEEL road-drag which is capable of taking the rhythmic bumps out of "washboardy" highways, has been placed on the market by the Miskin Scraper Works, Ucon, Idaho. This zigzag road-drag is 7½ feet wide and 14 feet long and weighs about 700 pounds. It is made of ¾ x 6-inch plow steel throughout and is guaranteed by the manufacturers to stand the rough usage to which it must be put in maintaining all types of dirt roads. The drag is long enough to span over and deposit loose material in small depressions while scraping the high spots, thus eliminating waves in the road.

By its form of construction, as noted in the illustration, it keeps the loose material zigzagging from one side of the drag to the other, filling the ruts and holes as it moves, and finally spreading nearly all of what is left out at the left-hand rear corner toward the center of the road if the drag



STEEL ROAD-DRAG WHICH CRISSCROSSES MATERIAL TO FILL DEPRESSIONS

is driven with traffic. The drag is not so heavy but that four medium-size horses can pull it all day with few rest periods and one tractor can handle it readily.

Stop the Big Little Leaks

Brand Your Tools and Equipment with the EVERHOT



Because the individual items are small, you pay scant attention to the little leaks that go on day after day, the year 'round. But at the end of the year these little leaks show up as being in reality the big leaks.

The money you spend each year, replacing shovels, picks, wheelbarrows, and other tools and equipment is a mighty big sum, especially when this equipment is not worn out, but simply disappears.

Put a complete stop to this loss by branding all your tools and equipment with the EVERHOT Tool. The mark put on by the EVERHOT is there to stay until the tool is worn out,—there is no changing or erasing it without destroying the tool.

The EVERHOT Tool is self-contained and can be used anywhere, anytime. The fuel is ordinary gasoline. It can also be used as a soldering iron or blow torch.



For CONCRETE CURING



CALCIUM CHLORIDE

The old laborious and expensive methods of curing concrete by ponding or by blanketing with dirt and straw and sprinkling with water, are entirely done away with by the up to date Calcium Chloride method of concrete curing.

Solvay Flake Calcium Chloride is applied direct to the bare concrete and requires no attention, no sprinkling, no dirt, no straw. Roads are ready for service in as little as ten days' time. Ordinary laborers do the work with hand shovels or the specially designed Solvay Spreader quickly and efficiently.

SOLVAY FLAKE Calcium Chloride

Solvay is shipped in 375-pound non-returnable metal drums or easy to handle 100-pound moisture-proof burlap paper-lined bags.

Seventy-five convenient distribution points in the United States give prompt service with minimum transportation charges. It will pay you to use Solvay. Write for latest information at once!

Ask for Booklet No. 2053.

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A Strictly One Man Machine
CAPACITY $1\frac{1}{4}$ to $2\frac{1}{4}$ CU. YDS.
PER MINUTE.



Equipped with absolutely positive and efficient excavating, feeding and cleanup device. Clears path 8 feet wide. Guaranteed to excavate harder material and to clean up better than any loader of its kind on the market, bar none.

Positive self-cleaning track, 1500 square inches of bearing surface, less than 10 lbs. per square inch.

Digging and crowding speeds 4 and 20 ft. per minute. Traveling speeds $\frac{1}{4}$ to $2\frac{1}{4}$ miles per hour.

Digging position quickly and easily adjusted and absolutely maintained by special grade control shoe.

Swivel chute permits loading in any position.

Write for literature and prices on Spearwell Loaders—a size for every need.

SPEARWELL MACHINERY CO.
Manufacturers of SPEARWELL CONSTRUCTION
OAKLAND EQUIPMENT CALIFORNIA

This Valuable Booklet Free

It is small in size, but packed with useful ideas on how to save money in digging and moving earth and other loose materials. It may help you to solve some difficult problem. Write for it today.

SAUERMAN BROS.
464 S. Clinton St.,
Chicago



SUPERIOR AUTOMATIC DUMP BODY

Automatically dump when loaded. Stiff leg holds body in dumping position until released by driver.



Body of one piece sheet steel with rounded self-cleaning corners. No chains to rattle. $1\frac{1}{2}$ yard capacity. Built for Ford, Indiana, International, Graham and Service Trucks. Manufactured by

SUPERIOR BOILER WORKS
MARION, IND.

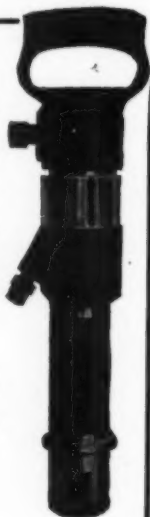
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CONCRETE DRILLING

Baby Plugger for drilling holes and cutting ducts in concrete.

Concrete Busher for bushing concrete surfaces.

A full line of Hand Tools used daily in your trade.



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have long been noted for their strength, long life and steady service under day in and day out operation.

The 207-S combines those features with new standards for compactness, speed and mobility to an extent which makes it, without question, the leader among one bag machines.

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Ask a LAKEWOOD user.



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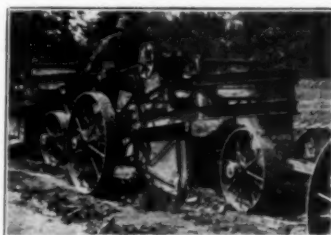
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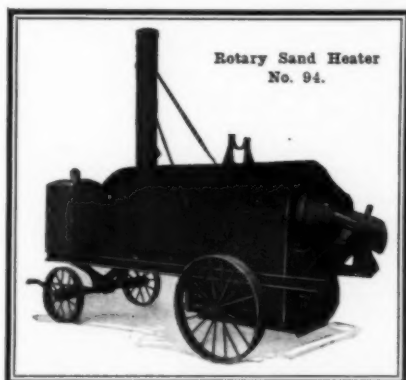
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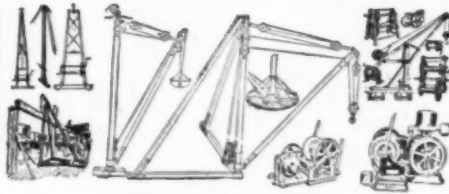
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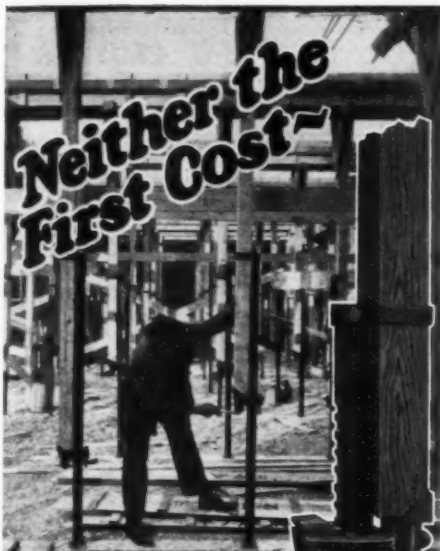


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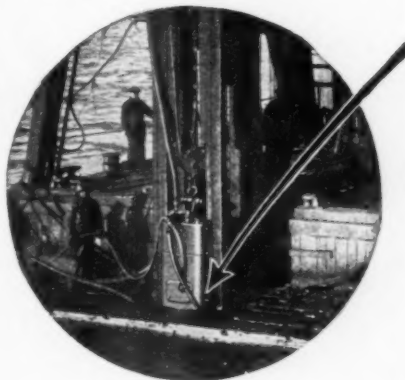
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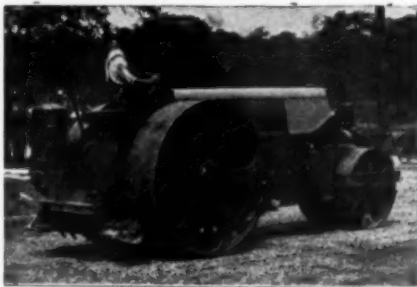
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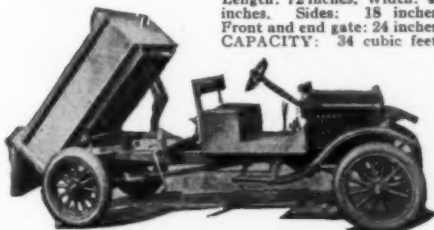
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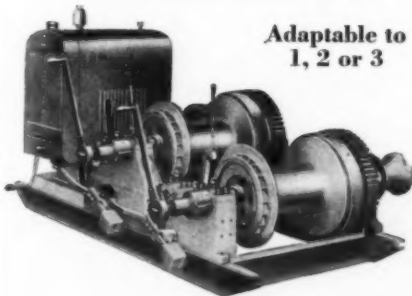


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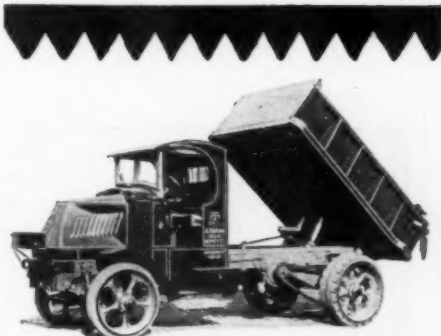
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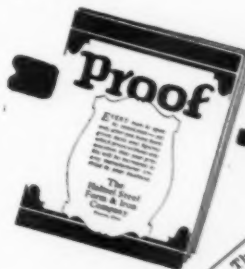
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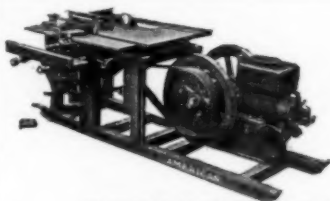
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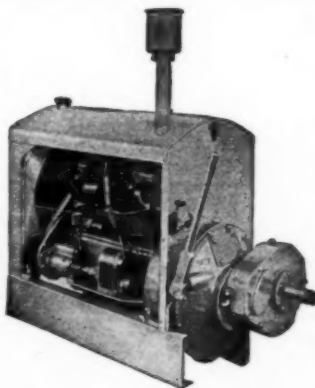
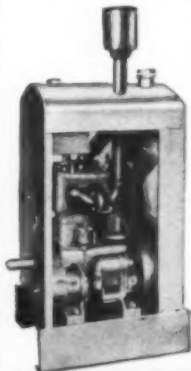
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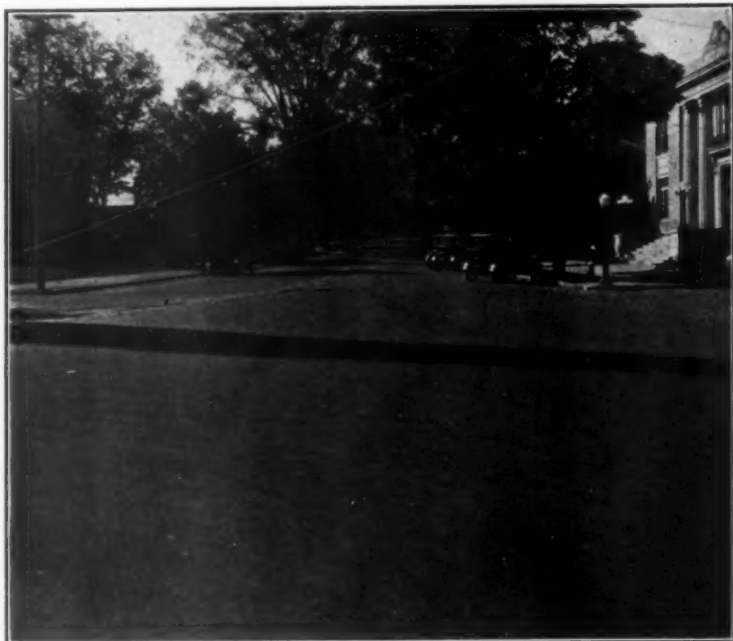
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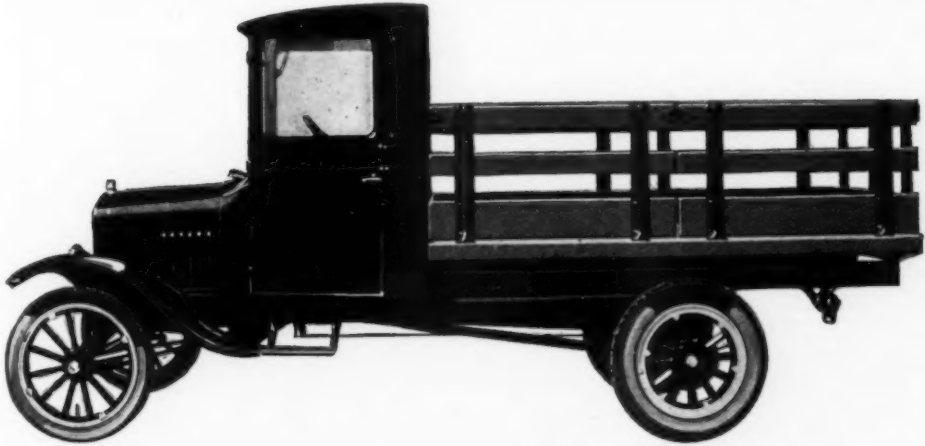
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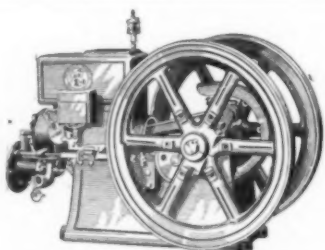
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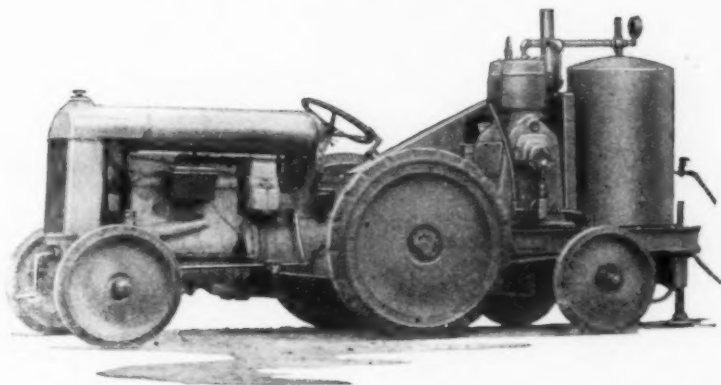
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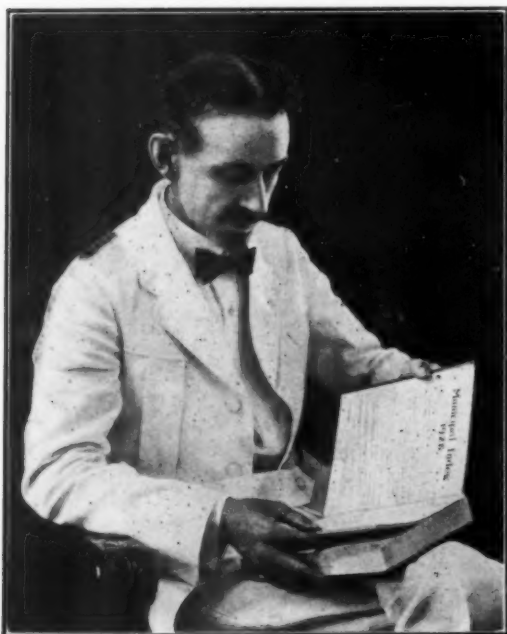
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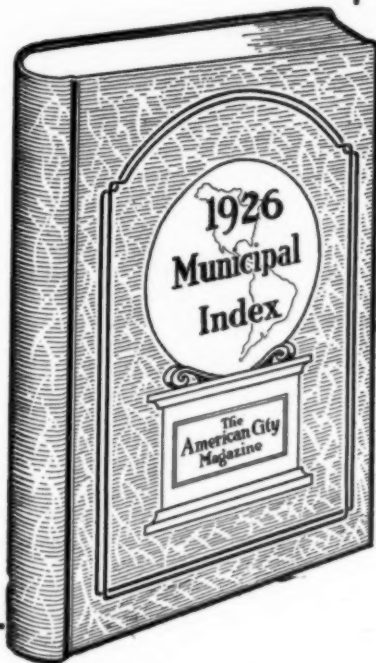
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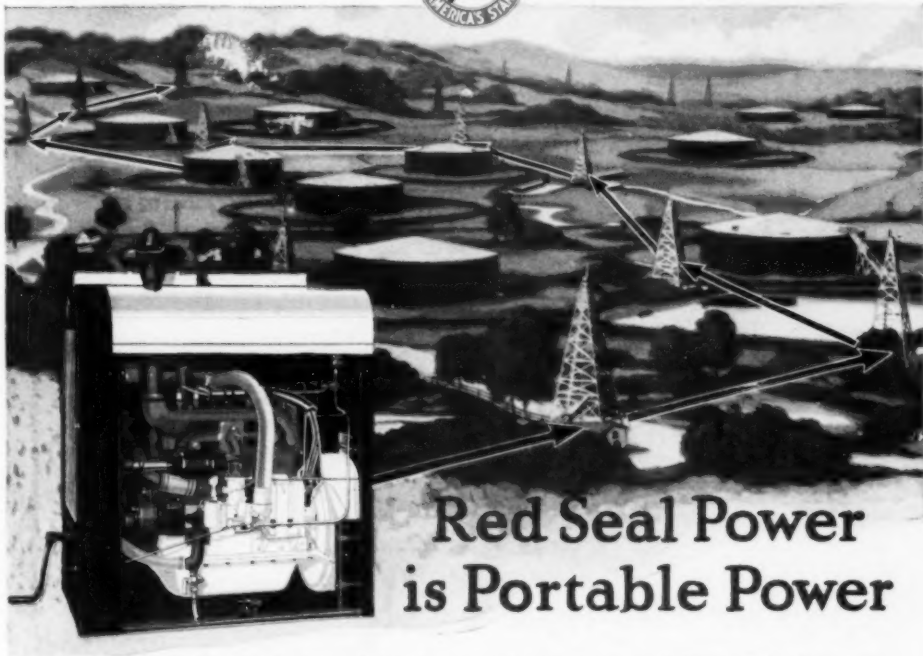
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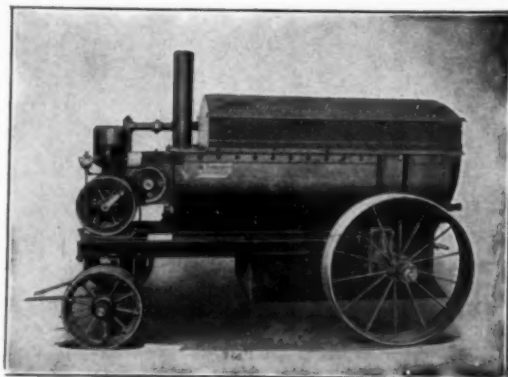


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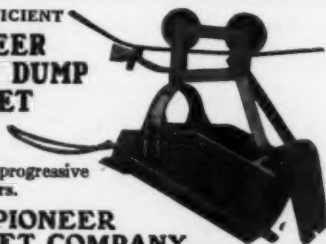
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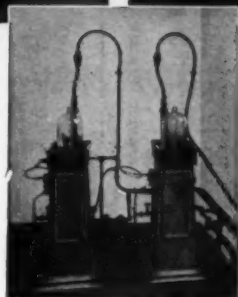
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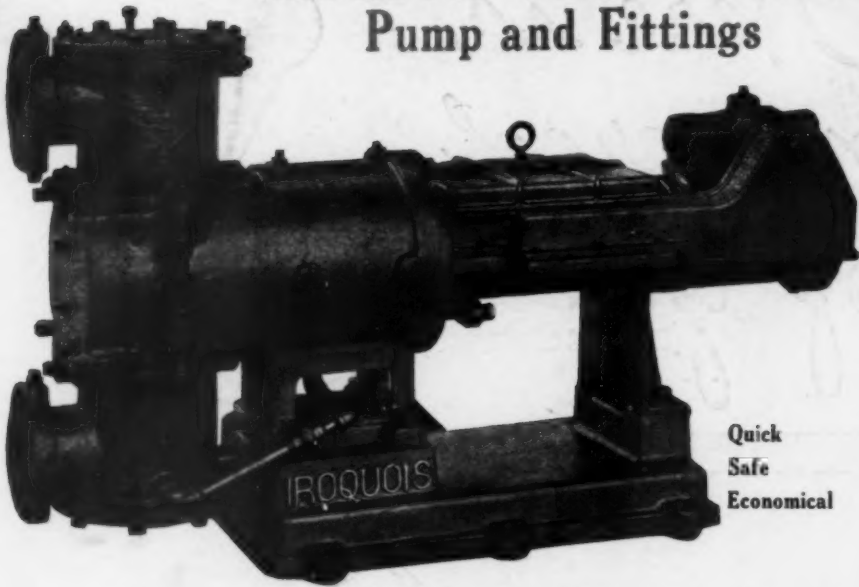
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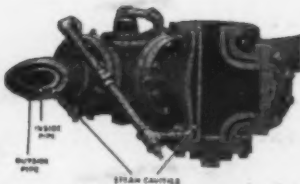
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